MakerBot

Replicator® 2X

EXPERIMENTAL 3D PRINTER

USER MANUAL

MakerBot

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NOTES

1

Welcome

This User Manual is designed to start your journey with the MakerBot® Replicator® 2X Experimental 3D Printer in the right direction. Your MakerBot Replicator 2X is optimized for ABS, a traditional thermoplastic that can be tricky and unpredictable. In order to achieve great results, you will need to experiment and tinker. That's why it's so crucial to take the time to learn about your new machine.

In this manual, you will learn how to set up and start using your Replicator 2X. You will also be introduced to Thingiverse and MakerWare. By the time you finish reading, you will know everything you need to start experimenting.

We are so excited to welcome you to the MakerBot community.
Let's get started!

SAFETY AND COMPLIANCE

RADIO AND TELEVISION INTERFERENCE

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiveris connected.
- Consult the dealer or an experienced radio/TV technician for help.

You may also find helpful the following booklet, prepared by the FCC: "How to Identify and Resolve Radio-TV Interference Problems." This booklet is available from the U.S. Government Printing Office, Washington D.C. 20402.

Changes and Modifications not expressly approved by the manufacturer or registrant of this equipment can void your authority to operate this equipment under Federal Communications Commission rules.

MANUFACTURER
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One MetroTech Center, 21st Floor
Brooklyn, NY 11201
347.334.6800

C ETL US LISTED
Intertek
4007863
I. T. E.

CE

WARNING: The MakerBot Replicator 2X Experimental 3D Printer generates high temperatures and includes moving parts that can cause injury. Never reach inside the MakerBot Replicator 2X while it is in operation. Always allow the MakerBot Replicator 2X to cool down before reaching inside.

WARNING: Do not leave the MakerBot Replicator 2X unattended during operation.

This **safety alert symbol** precedes each safety message in this manual. This symbol indicates a potential safety hazard that could harm you or others or cause product or property damage.

CAUTION: In case of emergency disconnect power supply from wall socket.

CAUTION: The socket outlet must be located near the equipment and must be easily accessible

CAUTION: The Replicator 2X melts plastic during printing. Plastic odors are emitted during this operation. Make sure to set up the Replicator 2X in a well-ventilated area.

SPECIFICATIONS

PRINTING

Print Technology:	Fused Filament Fabrication
Build Volume:	9.7"W x 6.4"L x 6.1"H [24.6 cm x 16.3 cm x 15.5 cm]
Layer Height Settings:	High 100 microns [0.0039 in] Medium 200 microns [0.0079 in] Low 300 microns [0.0118 in]
Positioning Precision:	XY: 11 microns [0.0004 in]; Z: 2.5 microns [0.0001 in]
Filament Diameter:	1.75 mm [0.069 in]
Nozzle Diameter:	0.4 mm [0.015 in]

SOFTWARE

Software Bundle:	MakerBot MakerWare™
File Types:	STL, OBJ, Thing
Supports:	Windows [7+], Ubuntu [11.10+], Mac OS X [10.6+]

PHYSICAL DIMENSIONS

Without Spools:	19.1 x 12.8 x 14.7 in [49 x 32 x 38 cm]
With Spools:	19.1 x 16.5 x 14.7 in [49 x 42 x 38 cm]
Shipping Box:	22.75 x 22.75 x 16.75 in [57.8 x 57.8 x 42.5 cm]
Weight:	27.8 lbs [12.6 kg]
Shipping Weight:	39.0 lbs [79.7 kg] [All packages]

TEMPERATURE

Ambient Operation:	15°–32° C [60°–90° F]
Storage Temperature:	0°–32° C [32°–90° F]

ELECTRICAL

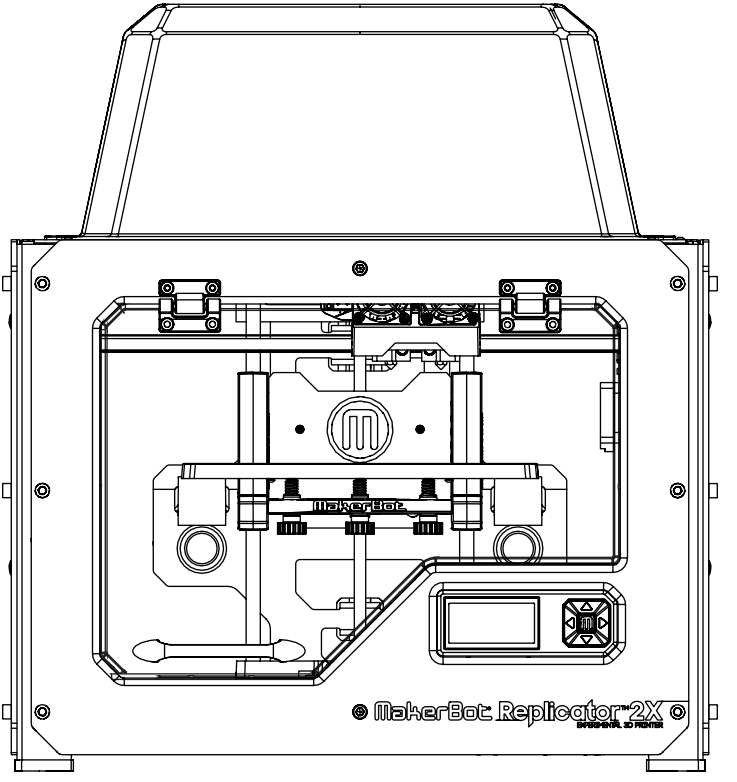
AC Input:	100–240V, ~4 amps, 50–60 Hz
Power Requirements:	24V DC @ 9.2 amps
Connectivity:	SD card [FAT16, max 2 GB]

MECHANICAL

Chassis:	Powder-coated steel
Body:	PVC Panels
Build Platform:	356 aluminum
XYZ Bearings:	Wear-resistant, oil-infused bronze
Stepper Motors:	1.8° step angle with 1/16 micro-stepping.

HOW IT WORKS

The MakerBot Replicator 2X Experimental 3D Printer makes solid, three-dimensional objects out of melted MakerBot Filament. Your 3D design files are translated into instructions for the MakerBot Replicator 2X and read by the machine via SD card. The MakerBot Replicator 2X then heats the MakerBot Filament and squeezes it out through a nozzle onto a heated surface to build a solid object, layer by layer. This method is called Fused Filament Fabrication [FFF].

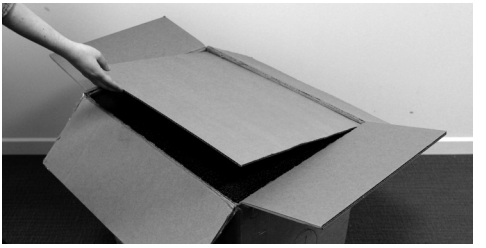


2

Setup

When you set up your MakerBot® Replicator®2X Experimental 3D Printer, remember that it was built and packaged very carefully at the MakerBot Factory. We hope you'll take your time and be just as careful unpacking it and getting set up.

UNPACKING YOUR MAKERBOT REPLICATOR 2X



1 Opening the Box

1a. Place the MakerBot Replicator 2X box on the ground. Open the box and remove the top cardboard sheet.

1b. Remove the MakerBot Replicator 2X User Manual. We recommend that you review the manual to guide you through the setup process and keep it handy as you unpack the contents of the box. If you find that anything described in the manual is missing, email us at support@makerbot.com.

1c. Remove the layer of foam and the sheet of cardboard underneath.

1d. Remove the two protective foam pieces from the sides of the MakerBot Replicator 2X.

2 Removing the MakerBot Replicator 2X from the box

Open the plastic covering and firmly grasp the frame of the MakerBot Replicator 2X. Be careful not to grip the rods or belts of the gantry system. Lift it out of the box and place it on a stable surface.

CAUTION: Do not force or tear anything during unpackingand setup. This may damage the MakerBot Replicator 2X.

MAKERBOT REPLICATOR 2X DIAGRAMS

[1] GANTRY SYSTEM

[2] LCD PANEL

[3] HEATED BUILD PLATE

[4] BUILD PLATFORM

[5] THREADED Z-AXIS ROD

[6] ENCLOSURE DOOR HANDLE

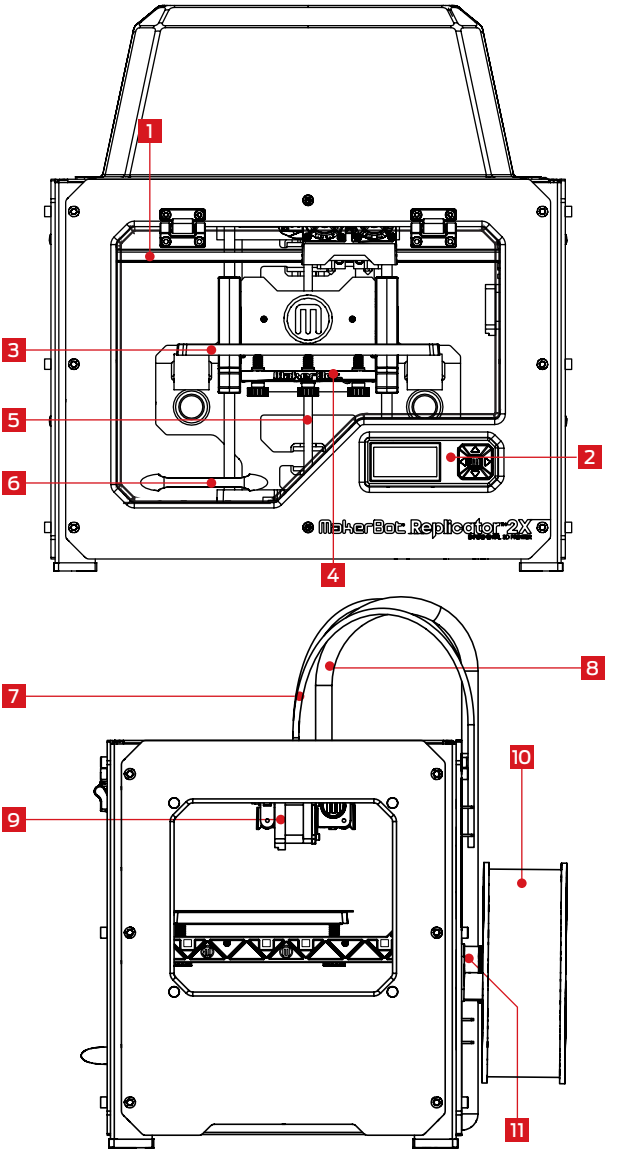
[7] FILAMENT GUIDE TUBES

[8] EXTRUDER CABLE

[9] EXTRUDERS

[10] FILAMENT SPOOL

[11] SPOOL HOLDERS



MAKERBOT REPLICATOR 2X DIAGRAMS CONTINUED

[1] FAN GUARDS

[2] EXTRUDER FANS

[3] EXTRUDER NOZZLES

[4] EXTRUDER LEVER ARMS

[5] FAN BOLTS

[6] CARTRIDGE HEATERS

[7] THERMAL CORES

[8] DRIVE BLOCKS

[9] EXTRUDER CABLE MOUNT

[10] MOTOR CABLE CONNECTORS

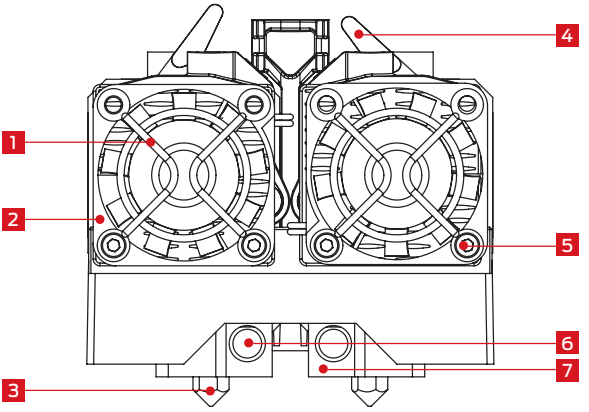
[11] EXTRUDER MOTORS

[12] HEAT SINKS

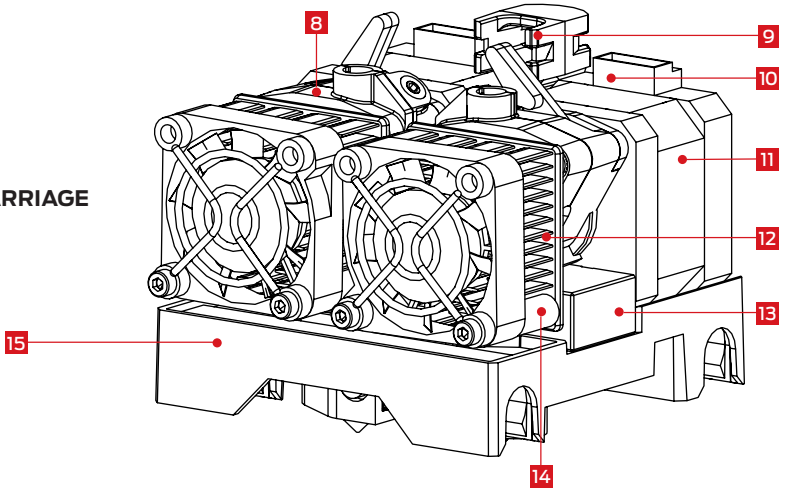
[13] BAR MOUNT

[14] SPACERS

[15] EXTRUDER CARRIAGE

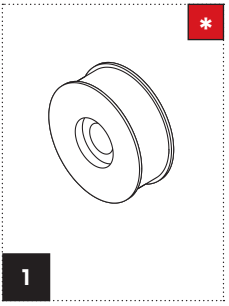


Front view of extruders

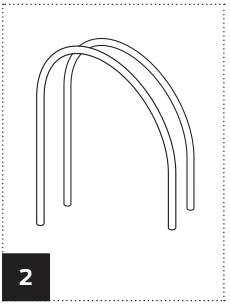


Angled view of extruders

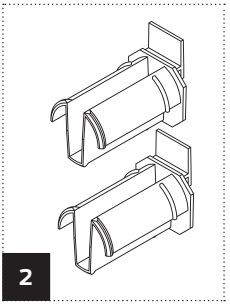
ACCESSORY BOX



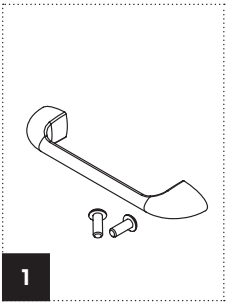
MakerBot ABS Filament [1 lb Spool]



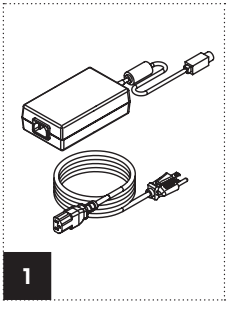
Filament guide tubes



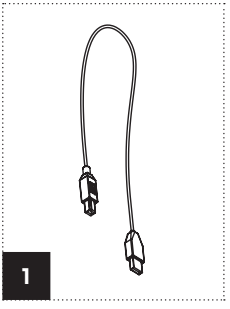
Spool holders



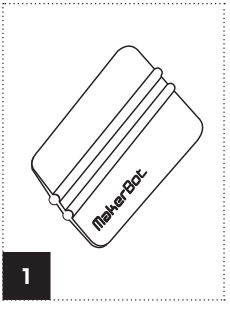
Handle and bolts



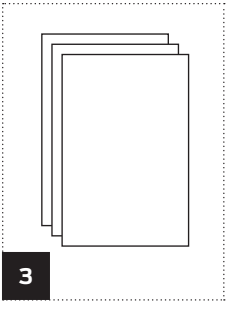
Power supply and cable



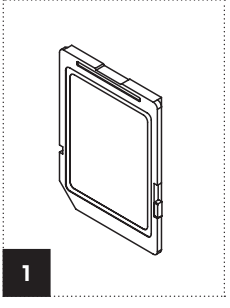
USB-A to USB-B cable



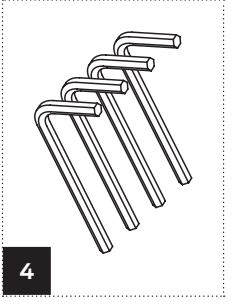
MakerBot tape applicator



Kapton tape sheets

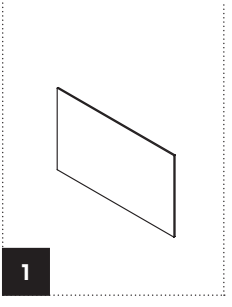


SD card



Hex wrenches

PTFE-based grease



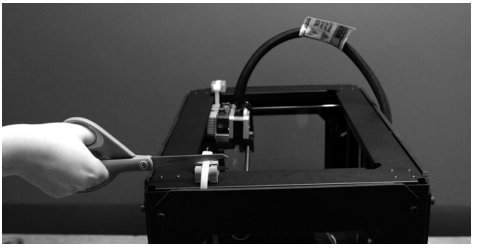
Support card

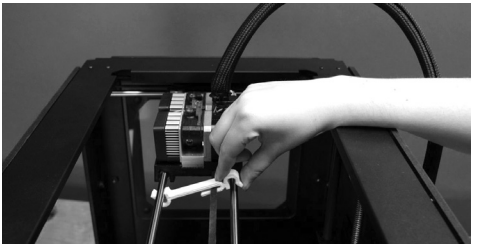
* More options available at makerbot.com/store

3 Removing the Accessory Box

3a. Remove the two remaining protective foam pieces from the bottom of the MakerBot Replicator 2X's box.

3b. Lift out the accessory box. This box contains the remaining items from the **Accessory Box** section.

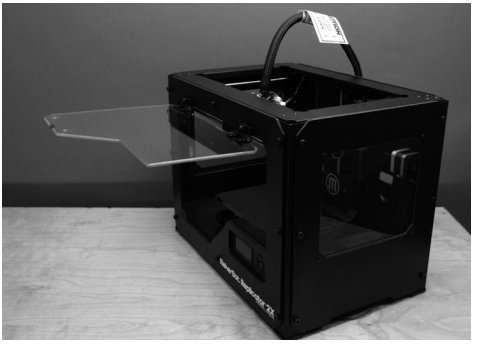


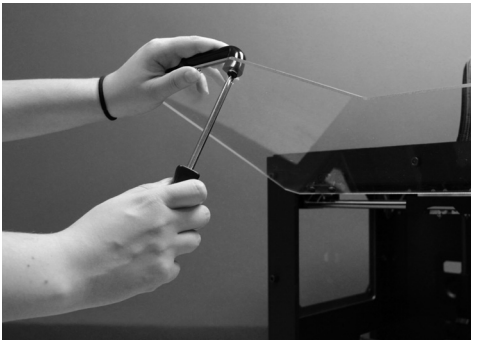


4 Freeing the Extruders

4a. Use strong scissors or a wire cutter to cut the zip ties holding the gantry system in place. Discard the zip ties and the plastic pieces holding them in place.

4b. A small plastic piece attached to the X-axis belt and gantry rods prevents the extruder from moving. Carefully snap the piece off of the rods and tilt it to slide it off of the belt.





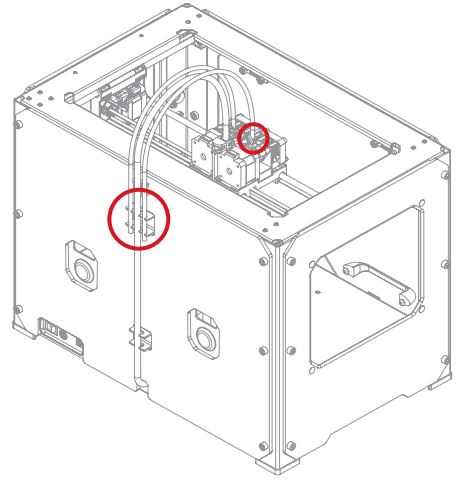
5 Installing the Enclosure Door Handle

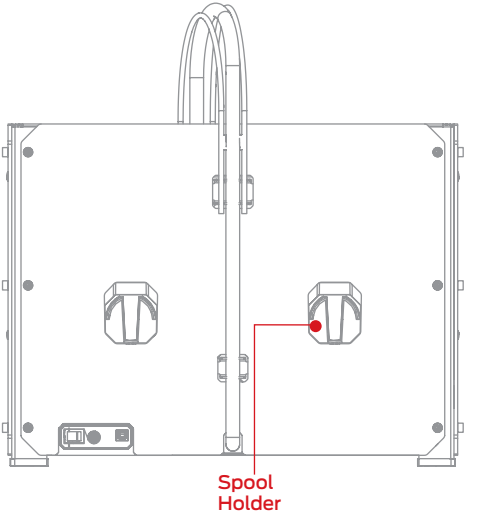
5a. Locate the handle kit in the accessory box. The kit includes your enclosure door handle and two buttonhead bolts.

5b. Open the enclosure door. To do this, reach through the top of the MakerBot Replicator 2X, push the door outward, and raise it to a 90º angle.

5c. Place the handle on top of the enclosure door. Align the holes in the ends of the handle with the pre-drilled holes in the enclosure door.

5d. Use your fingers to thread each bolt through the holes in the enclosure door and the handle. Use a Phillips head screwdriver to tighten the bolts. Close the enclosure door.



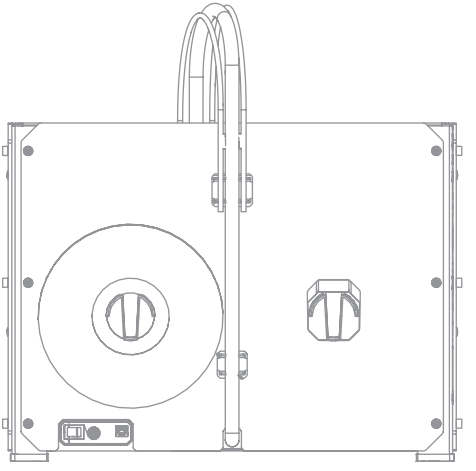


6 Installing the Filament Guide Tubes and Spool Holders

6a. Locate the two filament guide tubes. Insert one end of a filament guide tube into the hole in the top of one of the extruders. Push the filament guide tube in as far as it will go. Insert the end of the other filament guide tube into the hole on the top of the second extruder. Push the filament guide tube in as far as it will go.

6b. Insert the other end of one filament guide tube into the corresponding guide tube holder on the back of the MakerBot Replicator 2X. Make sure that the end of each filament guide tube is flush with the bottom of its guide tube holder. The filament guide tube should not hang down past the bottom of the guide tube holder. Repeat this process for the second filament guide tube.

6c. Locate the spool holders. Install the spool holders in the two rectangular openings on the back of the MakerBot Replicator 2X. To install a spool holder, tilt it and insert the square end into one of the openings



7 Mounting the Filament Spool

7a. Open the box containing your starter spool of MakerBot ABS Filament. Remove the spool from its plastic bag.

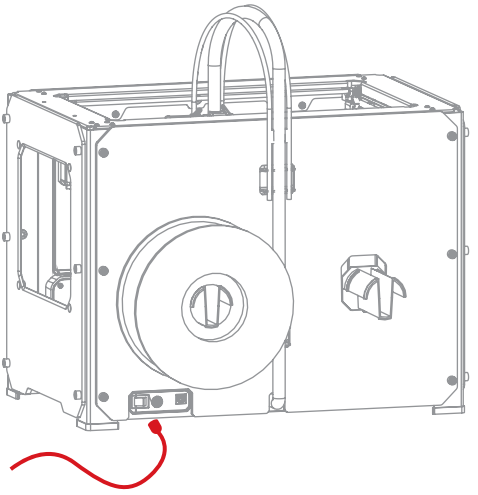
7b. Mount the spool on the left spool holder [when viewed from the back of the Replicator 2X]. Orient the spool so that it will unwind counterclockwise. Push the spool onto the spool holder until it locks. Do not let the filament uncoil or tangle as you load the spool onto the back of the MakerBot Replicator 2X.

NOTE: If a spool unwinds in the wrong direction, just turn it around. Spools are designed so that they can be installed on either side.

8 Installing the Enclosure Lid

8a. Locate the box containing the acrylic enclosure lid. The enclosure lid is shipped in a separate box and is not included in the same box as your MakerBot Replicator 2X.

8b. Unpack the enclosure lid and place it over your MakerBot Replicator 2X so that it covers the top of the frame, the extruder cable, and the filament guide tubes. The small indentations at the corners of the lid should line up with the bolt heads on the top of the MakerBot Replicator 2X's frame.



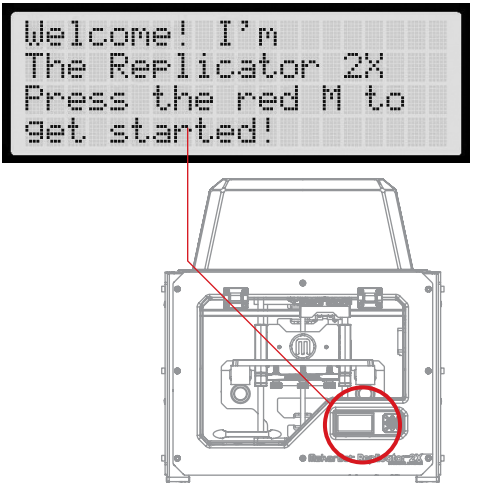
9 Attaching the Power Supply

10a. Locate the power supply and cable. Attach the cable to the power supply.

10b. Ensure that the power switch on the MakerBot Replicator 2X is set to the OFF position.

10c. Insert the power supply connector into the power input port on the back of the MakerBot Replicator 2X. Ensure that the flat side of the connector faces down.

NOTE: If at any time you need to unplug the MakerBot Replicator 2X, pull on the connector itself to release it from the power input port.



10 Powering On the MakerBot Replicator 2X

11a. Plug the AC power cord into an electrical outlet.

11b. Set the power switch to the ON position.

11c. The MakerBot Replicator 2X will display welcome text on the LCD panel. This is the beginning of the startup script that will guide you through initial calibration and your first 3D print.

CAUTION: The socket-outlet must be installed near the equipment and must be easily accessible.

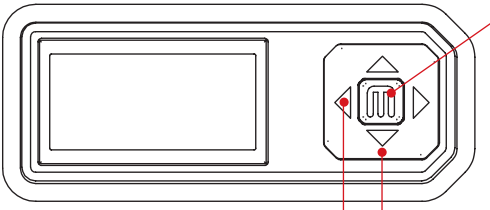
3

Startup

After you switch on the MakerBot® Replicator® 2X Experimental 3D Printer, the LCD panel will light up and display text. This text is the beginning of the Startup Script. The Startup Script will guide you through leveling the build plate, loading MakerBot ABS Filament, and creating your first 3D print.

START UP

THE LCD KEYPAD



- A solid red M means the MakerBot Replicator 2X is working.
- A blinking red M means the MakerBot Replicator 2X is waiting for user input.

The left arrow often allows you to go back or cancel an action.

Four arrow buttons surround a central M button. Use the arrows to navigate through the LCD menus and the M button to make selections.

NOTE: If you don't see the Startup Script, use the up and down arrow buttons to scroll through the top level menu on the LCD panel and use the M button to select Utilities. Scroll to Run Startup Script and select it. You can use these menus to return to the Startup Script at any time. You can view videos of the startup process on the MakerBot Replicator 2X video page at makerbot.com/support/replicator2x/videos. If you have any problems or questions, refer to the included Troubleshooting and Maintenance Guide or contact MakerBot Support by emailing support@makerbot.com.

LEVELING THE BUILD PLATE

Why Leveling Is Important

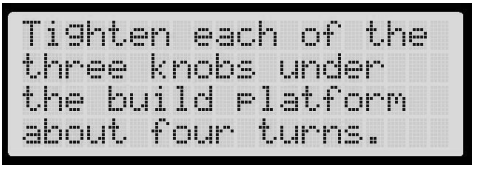
- If the build plate is too far from the extruder nozzles, or if one part of the plate is farther away from the nozzles than another part, your 3D prints might not stick to the build plate.
- If the build plate is too close to the extruder nozzles, the build plate can block the MakerBot Filament from extruding from the nozzles. This can also tear the Kapton tape applied to the build plate and scratch the aluminum surface underneath.
- Leveling your build plate often will help ensure that objects adhere well to the plate.

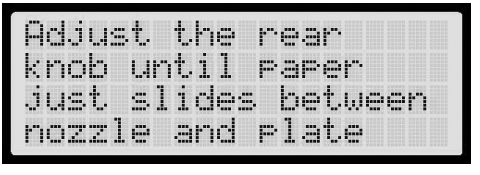
How to Level the Build Plate

Three knobs lower and raise the build plate.

- Tightening the knobs [turning them counterclockwise] moves the build plate away from the extruder nozzles.
- Loosening the knobs [turning them clockwise] moves the build plate closer to the extruder nozzles.
- The distance between the extruder nozzles and the build plate should be about the thickness of the MakerBot Support card included with your MakerBot Replicator 2X.

NOTE: To view a video of the build plate leveling process, go to the MakerBot Replicator 2X video page at makerbot.com/support/replicator2x/videos.



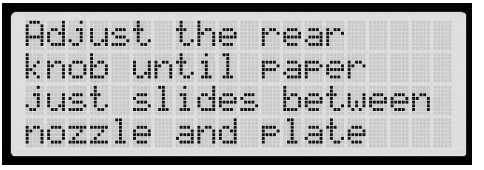


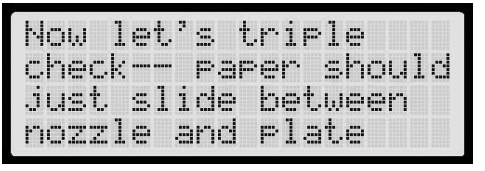
1 Adjust the Knobs as Directed

When directed by the LCD screen, tighten each of the three knobs underneath the build platform approximately four turns.

Next, the script will prompt you to adjust the knobs individually. Use the MakerBot Support business card or a thin piece of paper to check the plate height above each knob.

As you adjust each knob, make sure the MakerBot Support card just slides between the nozzles and build plate. You should feel some friction on the card but still be able to easily pass the card between the plate and the extruder nozzles without tearing or damaging the card.





2 Adjust Each Knob Again

The script will prompt you to adjust each knob again. This allows for fine tuning. This time, the Support card should slide between the build plate and nozzles with more friction.

3 Confirm your Adjustment

After the second set of adjustments, the nozzles will move to the center of the build plate. Confirm that the MakerBot Support card slides between the nozzles and plate with a moderate amount of friction.

NOTE: During leveling, it is okay for the nozzle to be very slightly closer to the center of the build plate than to the rest of the plate.

4 Finish Leveling

When you have completed the initial leveling tasks, the LCD menu will display the following text: "Aaah, that feels much better. Let's go on and load some plastic!" Before you can print, you must load the MakerBot ABS Filament into the extruder. The extruder will heat the filament and use the melted material to build things.

NOTE: If you have problems with this process or if you need to level your build plate again, you can use the up and down arrows to scroll through the top-level menu on the LCD panel and use the M button to select Utilities. Scroll to Level Build Plate and select it. You can use these menus to return to the leveling script at any time.

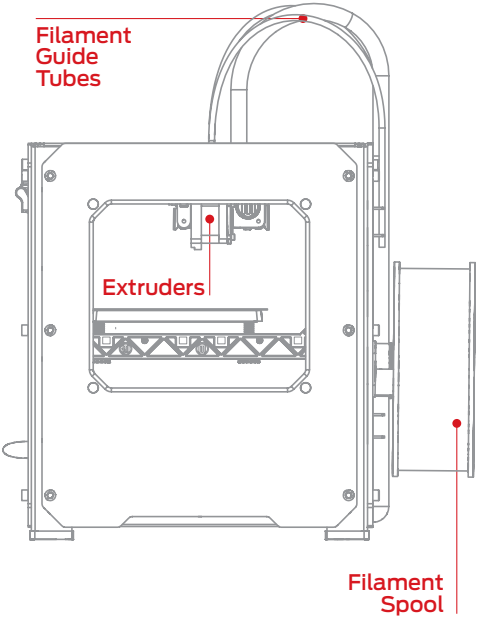
LOADING MAKERBOT FILAMENT

1 Remove the Enclosure Lid

Lift the enclosure lid from the top of the MakerBot Replicator 2X and set it aside.

2 Detach the Filament Guide Tube on the Right

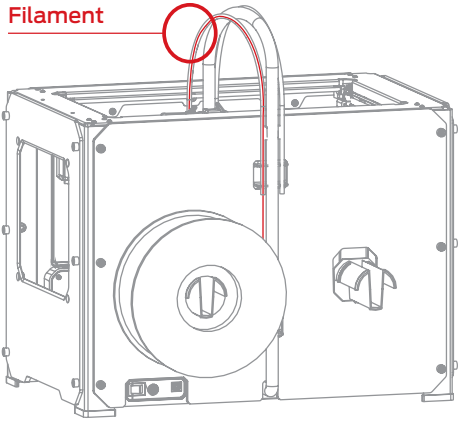
Locate where the right-side filament guide tube enters the right extruder. Detach the guide tube by gently pulling it out of the extruder.

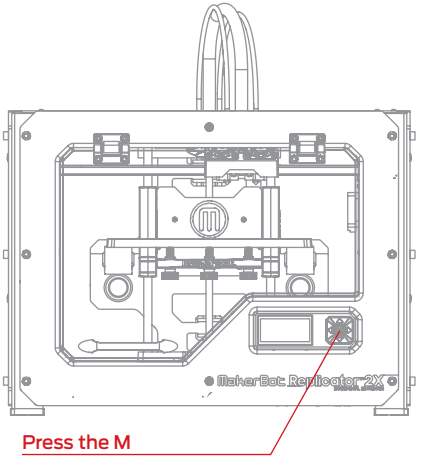


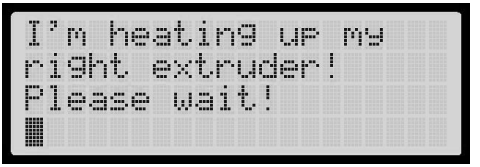
3 Feed the Filament through the Filament Guide Tube

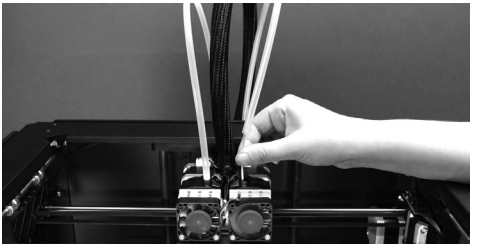
Free the end of the MakerBot ABS Filament from your starter spool. Use scissors to cut away any bent filament and feed the end of the spooled filament into the left side filament guide tube [when viewed from the back] where it attaches to the back of the MakerBot Replicator 2X. Continue to feed the filament in until it emerges from the other end of the tube.

NOTE: To avoid filament jams, always ensure that any filament spool you mount on the Replicator 2X feeds from the bottom of the spool toward the top. Filament mounted on the right spool holder [when viewed from the back] should always unspool clockwise and filament loaded onto the left spool holder should always unspool counterclockwise.









4 Press the M to Begin Heating the Right Extruder

After you feed the MakerBot ABS Filament all the way through the filament guide tube, press the M button on the LCD panel. The MakerBot Replicator 2X will start to heat the right extruder.

CAUTION: Do not touch the extruders while they are heating — they heat to 230° C.

5 Press the M to continue

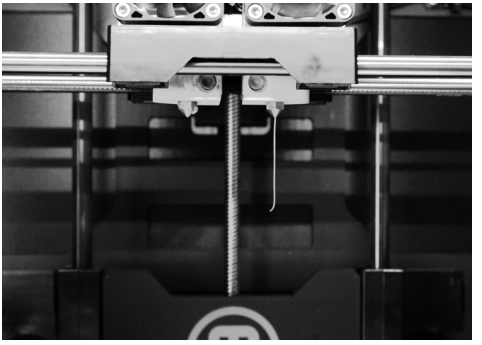
After the extruder reaches 230° C, the LCD panel will prompt you to load filament into the right extruder. Click through the message until your MakerBot Replicator 2X asks you to press the M when you see plastic extruding.

6 Push the Filament into the Right Extruder

Take the end of the MakerBot ABS Filament emerging from the end of the filament guide tube and firmly push it into the hole in the top of the right extruder. Ensure that the filament goes into the center of the opening and doesn't get caught at the edge of the opening.

Maintain pressure on the filament and continue pushing it into the opening.

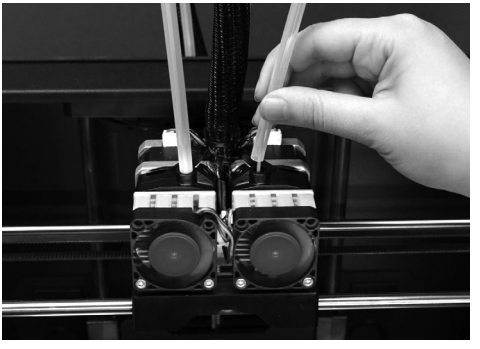
After about five seconds, you should begin to feel the motor pulling in the filament. Maintain pressure for another five seconds and then let go.



7 Stop Extrusion

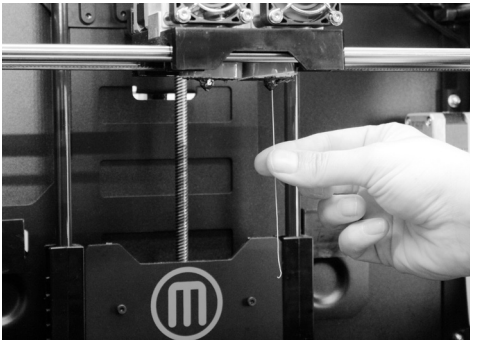
After a few moments, you should see a thin string of the MakerBot ABS Filament come out of the right extruder nozzle. The filament might curl and then straighten; this is normal. Press the M button to stop extrusion.

NOTE: Don't be surprised if the plastic that initially comes out of the nozzle is not the color you expected. This is filament left over from testing. Wait until you see the color that you loaded come out of the nozzle before you press the M button.



8 Reattach the Filament Guide Tube

Push the guide tube back into the opening on the top of the right extruder.



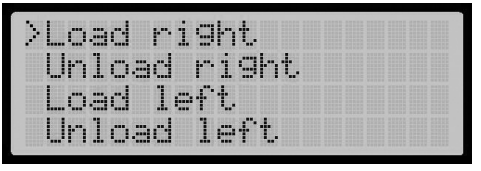
9 Remove the Extruded Plastic

Wait a few minutes for the extruded ABS plastic to cool, then pull it away from the right extruder nozzle. You can discard this extra plastic.

CAUTION: Do not touch the nozzle; it may still be hot.

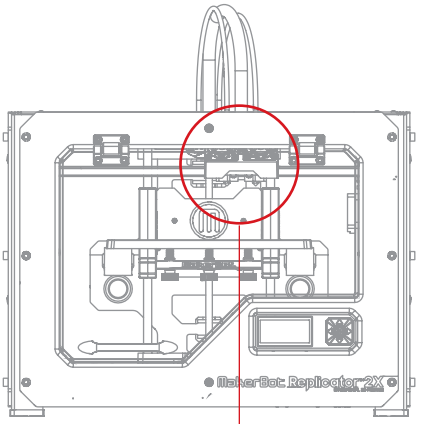
Don't leave plastic clinging to the extruder nozzles. This can cause newly extruded plastic to stick to the nozzles instead of the build plate.

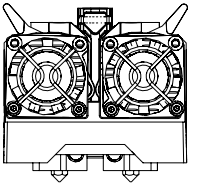
NOTE: If you have problems or need to load MakerBot Filament again, you can use the up and down arrows to scroll through the top-level menu on the LCD panel and use the M button to select Utilities. Scroll to Change Filament and select it. Then select Load Right or Load Left. You can use these menus to return to the load scripts at any time.



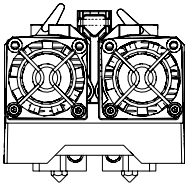
Unloading MakerBot ABS Filament

If you need to unload filament, the LCD menu will walk you through the process. To run the script for unloading the filament from either extruder, go to the LCD panel and select Utilities > Filament Options > Unload.





Extruder arms open



Extruder arms closed

Can't load filament?
If you are having problems loading filament into one of the extruders, perform the following steps:

1. Go to the LCD panel and select Utilities > Filament Options > Unload. This option heats the extruders.

2. Set the extruder arm to the open position.

3. Make a fresh cut at the end of the filament. It is important that the filament have nobends in it. If it does, cut off the bentsection of filament.

4. Insert the filament into the hole at the top of the extruder. Keep pushing it in until you start to see plastic come out of the nozzle.

5. When the filament is successfully loaded, set the extruder lever arm to the closed position.

If filament still doesn't emerge from the nozzle, remove the filament from the top of the extruder and check for a bend at the end of the filament. If the filament is bent, it is possible that the filament is slipping under the extruder bearing instead of entering the extruder heater. Remove the extruder fan and assembly using the instructions in the section **Disassembling an Extruder**. This will allow you to watch the filament travel through the extruder and determine where the filament is getting stuck.

It is also possible that you are unable to load filament because a broken piece of filament remains inside of the extruder. Remove the extruder fan and assembly using the instructions in the section **Disassembling an Extruder** and use a pair of pliers to remove the broken end of filament.

Can't unload filament?
If you cannot unload filament from one of the extruders, do the following:

1. Go to the LCD panel and select Utilities > Filament Options > Unload. This option heats the extruders.

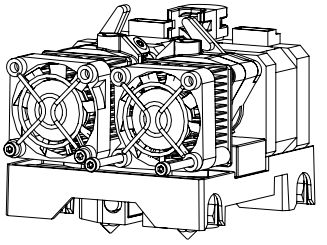
2. Set the extruder lever arm to the open position.

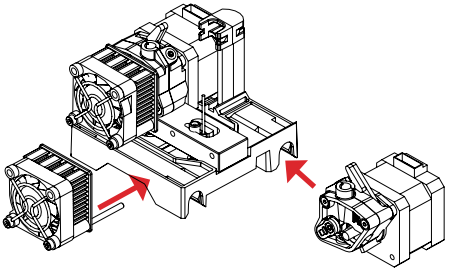
3. Push about half an inch of filament through the extruder.

4. Try pulling the filament out of the extruder again.

Extruder stays heated after loading or unloading filament?
If your extruder stays hot after loading filament or unloading filament, you might have enabled the Preheat option. To turn off the Preheat option, go to the LCD panel and select Preheat > Cool. This disables the heaters.

Disassembling an Extruder
Occasionally you may need to take an extruder apart for troubleshooting purposes. This is a simple process that will require no tools other than the 2.5 mm hex wrench you received with your MakerBot Replicator 2X.





To disassemble an extruder:

1. Unload the MakerBot Filament from the extruder. To run the script for unloading filament, go to the LCD panel and select Utilities > Filament Options > Unload.

2. Switch off the power on the MakerBot Replicator 2X and unplug the power supply. Pull on the connector to release it from the power input port.

3. Unscrew the two bolts at the lower corners of the fan guard using your 2.5mm hex wrench. As one piece, remove the fan guard, the fan, the heat sink, and the spacers. Keep these pieces assembled and move them out of the way.

4. Unplug the motor wire harness from the top of the extruder motor and slide the motor assembly out of the extruder.

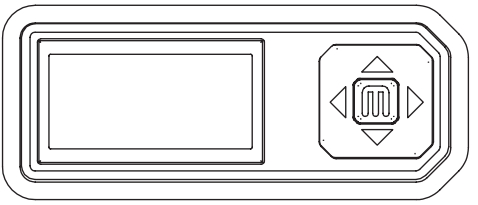
5. The extruder is now broken down into its main assemblies.

4

LCD Menus

This chapter describes the menus and options available in the LCD panel on the MakerBot Replicator 2X.

LCD MENUS



THE LCD KEYPAD
The LCD Keypad includes four arrow buttons surrounding a central M button.

- Use the arrows to navigate through the LCD menus and the M button to make selections.
- The left arrow often allows you to go back or cancel an action.
- A solid red M means the MakerBot Replicator 2X is working. A blinking red M means the MakerBot Replicator 2X is waiting for user input.

TOP LEVEL ENTRIES
Before you have selected anything in the LCD panel, you will see these top-level menu entries:

Build from SD
This option allows you to print an X3G file from an SD card

- Use the M button to select Build from SD.
- Use the up and down arrows to choose from the list of files on your SD card.
- Press M to start a print.
- Select Exit Menu or the left arrow button to return to the top-level menu.

Preheat
To preheat your MakerBot Replicator 2X, select **Preheat**. Preheating reduces the amount of time it takes to heat the plate and extruders when you begin a print.

- Choose the parts of the MakerBot Replicator 2X that you want to preheat. Use the arrow buttons to navigate to "Right Tool", "Left Tool", or "Platform". Use the "M" button to toggle a setting between "ON" and "OFF" For example, if you want to print with dual extrusion, set both extruders to ON. If you are printing with ABS, set the platform to ON.
- To start the preheat, use the up arrow and down arrow to choose "Start Preheat!" Select the M button to start the preheat.
- If you need to stop the preheating process, just go to the Preheat menu again and use the up arrow or down arrow to choose "Cool!" Use the M button to turn off the preheat.

Utilities
The **Utilities** menu contains controls for your MakerBot Replicator 2X and scripts for processes like loading filament and leveling the build plate.

Info and Settings
The **Info and Settings** menu displays information about your MakerBot Replicator 2X and allows you to change settings on your MakerBot Replicator 2X.

UTILITIES MENU

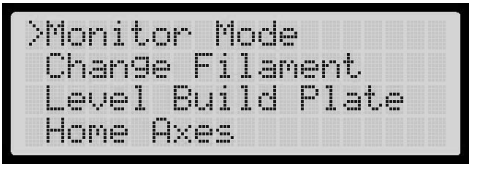


Fig. 4.1

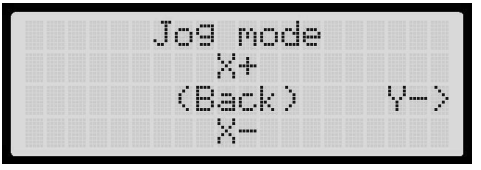


Fig. 4.2

THE UTILITIES MENU
The **Utilities** menu contains controls for your MakerBot Replicator 2X and scripts for processes like loading filament and leveling the build plate.

Monitor Mode. This entry displays the current temperature of your extruders and build plate. The display is updated as the temperatures change.

Change Filament. This entry launches scripts that walk you through loading and unloading filament. See **Help Text** in the **General Settings** section below for information on how to make the scripts less verbose.

To stop any of the **Change Filament** scripts, press the left arrow button and select "Yes" when prompted.

Level Build Plate. This entry walks you through the process for leveling the build plate. The script moves the extruders to different points on the plate and prompts you to adjust the plate height at each point.

To stop the **Level Build Plate** script, press the left arrow button and select "Yes" when prompted.

Home Axes. This entry moves your build platform and extruders to their default positions.

Jog Mode. This entry allows you to change the position of the build platform and the extruders. [Fig. 4.2] Use the left and right arrows to select the X, Y, or Z- axis, the up and down arrows to move your extruders or build platform along the chosen axis, and the center button to exit Jog Mode. Jogging the Z-axis will move your platform up and down, and jogging the X and Y-axes will move your extruder right and left and backwards and forwards, respectively.

Run Startup Script. This entry launches the startup script. The Startup Script runs automatically the first time you power on the MakerBot Replicator 2X. The Startup Script walks you through the steps for leveling your build plate, loading filament into the right extruder, and printing from the SD card. To exit the Startup Script, press the left arrow button. You will not be able to exit the Startup Script until the leveling portion of the script begins.

Disable Steppers/Enable Steppers. This entry allows you to toggle on and off the stepper motors that move the extruders and build platform. If you need to manually move the build platform or the extruders, you must first disable the stepper motors.

Blink LEDs/Stop Blinking. This entry allows you to toggle on and off blinking. When toggled on, the LEDS in the MakerBot Replicator 2X will start blinking. When toggled off, the LEDs in the MakerBot Replicator 2X will stop blinking.

Calibrate Nozzles. This entry launches a script that allows the MakerBot Replicator 2X to correctly locate the two extruder nozzles. Use this script if your dual extrusion prints don't appear to line up correctly on the plate. The script will print a series of lines with each nozzle and ask you to choose the ones that line up best. Your MakerBot Replicator 2X will store that information and use it to make your dual extrusion prints align better in the future.

Exit Menu. This entry returns you to the top-level menu.

INFO AND SETTINGS MENU

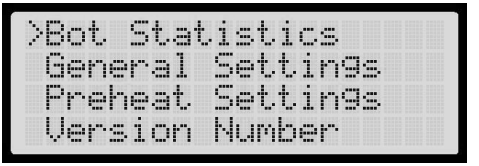


Fig. 4. 3

Fig. 4. 4

THE INFO AND SETTINGS MENU
The Info and Settings menu displays information about your MakerBot Replicator 2X and allows you to change settings on your MakerBot Replicator 2X. [Fig. 4.3]

Bot Statistics. This entry displays the total build time, in hours and minutes, during the lifetime of your MakerBot Replicator 2X. It also displays the duration of the last completed build.

General Settings. This entry leads to a sub-menu that allows you to change settings on your MakerBot Replicator 2X. [Fig. 4.4]

To navigate the entries under **General Settings**:
- Use the up and down arrows to navigate to the setting you want to change.
- Use the M button to select the setting you want to change.
- Use the up and down arrows to scroll through the available options for each setting.
- Use the M button to select and confirm your change to a setting.

Sound. This entry toggles the indicator sounds ON and OFF. Setting this entry to OFF stops the MakerBot Replicator 2X from beeping when you turn it on or when a print finishes. However, this option will not eliminate all sound made by your Replicator 2X. The sounds you hear during printing come from the stepper motors and cannot be turned off.

LED Color. This entry allows you to change the color of the LEDs in the frame of the MakerBot Replicator 2X. The LEDs can be set to WHITE, RED, ORANGE, PINK, GREEN, BLUE or PURPLE, or turned OFF.

Accelerate. This entry toggles acceleration ON and OFF. Acceleration is set to ON by default. Acceleration allows your MakerBot Replicator 2X to operate more smoothly. If you set Acceleration to OFF, do not use printing speeds faster than 45mm/s.

Heat Hold. This entry tells your MakerBot Replicator 2X to continue heating your extruders after a build is cancelled. You can set the hold time from one minute to thirty minutes. To turn this setting off, set it to zero minutes.

Help Text. This entry toggles verbose help text ON and OFF. Turning it ON provides verbose help text during scripts. Turning it OFF provides abbreviated help text during scripts.

Heat LEDs. This entry toggles heat indicators ON and OFF. When this entry is set to ON, the LED color will change from the default color to blue when the heating process begins and from blue to red when the extruders start to heat. When the MakerBot Replicator 2X reaches the target temperatures, the LED color returns to the default color.

Tool Count. This entry displays the number of extruders your MakerBot has. The MakerBot Replicator 2X has DUAL extruders.

Heated Plate. This entry displays whether your MakerBot has a heated build plate. The MakerBot Replicator 2X has a heated build plate.

Exit menu. This entry returns you to the Info and Settings menu.

Preheat Settings. This entry lets you change the preheat temperatures for the extruders and build plate. Remember that that the temperatures are in degrees Celsius.

- Use the up and down arrows to navigate to the setting you want to change (Right Tool, Left Tool, Platform)
- Use the M button to select the setting you want to change.
- Use the up arrow and down arrow to scrollthrough the available options for each setting.
- Use the M button to select and confirm your setting.

Version Number. This entry displays the version number for the firmware on your MakerBot Replicator 2X.

Restore Defaults. This entry restores your MakerBot Replicator 2X to the default, factory settings. This option affects only settings that you can change through the LCD menus. Settings that you can change only using Makerware will not be restored.

Exit menu. This entry returns you to the top-level menu.

ACTIVE BUILD MENU

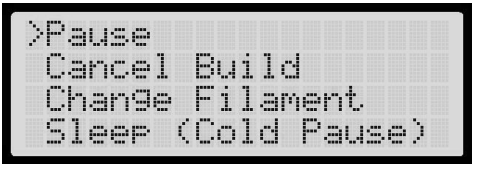


Fig. 4.5

THE ACTIVE BUILD MENU
The LCD panel includes options and settings for use during printing. [Fig. 4.5] To access these settings during a print, select the left arrow.

Pause. This entry allows you to stop a print briefly. During Pause, your extruders and build platform will not move from their current locations. Use Pause only to stop a print briefly. MakerBot does not recommend allowing a heated nozzle to remain stationary and in contact with your print for long period of time.

Cancel Build. This entry stops a build permanently. After you choose this option, you will be prompted to confirm that you want to cancel the build.

Change Filament. This entry allows you to move the extruders away from your print, change filament, and then resume the print. This entry is useful for printing multi-colored objects or for changing an empty spool of filament. After you change the filament, select the left arrow button to return to the **Active Build** menu. Select the entry for Resume Print.

Sleep (Cold Pause)/Resume Build. This entry allows you to pause a print for long periods of time. When you select this option, your Replicator 2X will complete any queued commands before moving the extruder away from your print and allowing the extruders and build plate to cool. During a cold pause, the menu option will change to **Resume Build**. Press M to resume printing.

Fig. 4. 6

Fig. 4. 7

Z Pause Height. This entry allows you to pause your print at a set height. When you select this option, you will see two additional settings: **Z Position** and **Pause Active**. [Fig. 4.6] To set the pause height, scroll to Z Position, press the M button, and use the arrows to increase the pause height in millimeters. Press the M again to confirm the height. Scroll to **Pause Active** and use the M button to toggle the setting ON and OFF. When **Pause Active** is set to ON, a Z height pause will be triggered, even if the Z Position is set to 0.

Filament Fan. This entry allows you to set an active cooling fan to ON or OFF during a build. The MakerBot Replicator 2X does not include an active cooling fan.

LED Color. This entry allows you to change the color of the LEDs in the frame of the MakerBot Replicator 2X. The LEDs can be set to WHITE, RED, ORANGE, PINK, GREEN, BLUE or PURPLE, or turned OFF. Use the up arrow and down arrow to scroll through the available colors. Use the M button to select and confirm your selection.

Build Statistics. This entry displays the elapsed time for the current build and the line number of the command being executed by your Replicator 2X. [Fig. 4.7]

Back to Monitor. This entry returns you to the Monitor screen. The Monitor screen displays the percent of the print that has been completed and the temperatures of the **Right Extruder**, **Left Extruder**, and **Platform**.

5

Printing from SD

Your MakerBot Replicator 2X includes an installed SD card. This card contains sample objects so you can start printing immediately. This chapter will walk you through the steps to print sample objects.

MAKING A TEST OBJECT FROM THE SD CARD

LOCATE THE SD CARD
The MakerBot Replicator 2X includes an SD card preloaded with files for making test objects. The SD card is located in the SD port, directly behind the LCD panel. Make sure the SD card is pushed firmly into the SD port.

SELECT A PROJECT FROM THE SD CARD
The final task in the Startup Script is to print an object from the SD card. After you have successfully leveled the build plate and loaded the MakerBot ABS Filament into the right extruder, the LCD panel will ask you: "How'd it go? Ready to make something?" Select "Yes" and the LCD panel will display: "Awesome! We'll go to the SD card menu and you can select a model!"

If you want to print from the SD card but are not running the Startup Script, use the LCD panel to navigate back to the top-level menus.

1. Select **Build from SD**.

2. Use the arrow keys to navigate through the list of models available. The models come pre-loaded on your SD card are also shown on the following page of this manual.

3. To select a model, press M.

4. The MakerBot Replicator 2X will begin to make your object. You can use the LCD panel to monitor the temperature of the extruders and build plate and the status and progress of your object.

EXAMPLE: PRINTING THE CHAIN LINKS
In this section, we will print the chain links object from the SD card. To do this:

1. On the LCD panel, navigate back to the top-level menus. Select **Build from SD**.

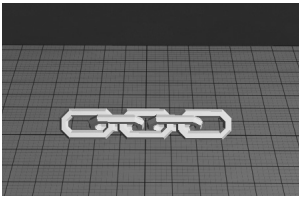
2. Use the arrow keys to navigate through the list of models on the SD card. Find the chain links model.

3. To choose the chain links, press M.

4. The MakerBot Replicator 2X will begin to make your object. Once the build plate and extruders have reached their target temperatures, the print will take about 12 minutes. You can use the LCD panel to monitor the temperature of the extruders and build plate and the status and progress of your object.

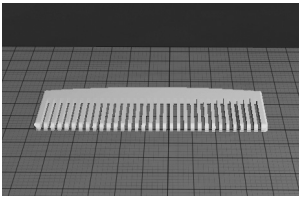
CHAIN LINKS
File Name: Chain Links
Make Time: 12 Minutes

Design By: Sal
Thingiverse: 28405



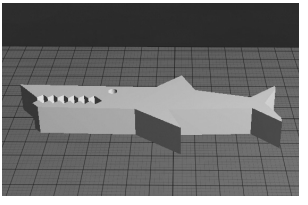
COMB
File Name: Comb
Make Time: 14 Minutes

Design By: repraprook
Thingiverse: 1140



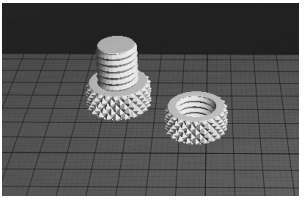
MR JAWS
File Name: Mr Jaws
Make Time: 18 minutes

Design By: Mahoney
Thingiverse: 14702



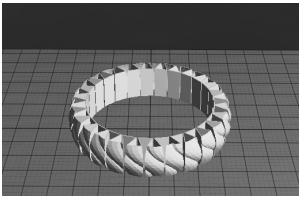
NUT AND BOLT SET
File Name: Nut and Bolt
Make Time: 27 minutes

Design By: aubenc
Thingiverse: 9095



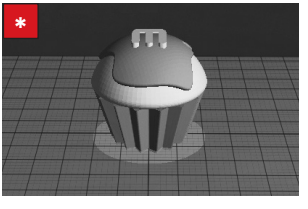
STRETCHY BRACELET
File Name: Stretchlet
Make Time: 16 minutes

Design By: Emmett
Thingiverse: 13505



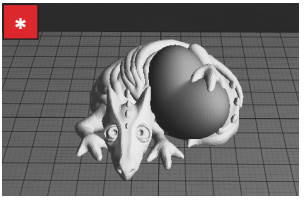
CUPCAKE
File Name: Cupcake
Make Time: 52 minutes

Design By: Will Langford
Thingiverse: 16824



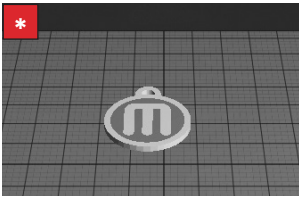
PET MONSTER VALENTINE
File Name: Heartless Dragon
Make Time: 40 minutes

Design By: andreas, tbuser
Thingiverse: 29088



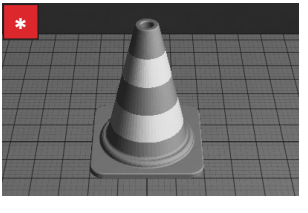
MAKERBOT PENDANT
File Name: pendant
Make Time: 8 minutes

Design By: Todd
Thingiverse: 25556



TRAFFIC CONE
File Name: Traffic Cone
Make Time: 42 minutes

Design By: CocoNut
Thingiverse: 21773



* Dual extrusion prints require two colors of MakerBot ABS filament loaded into your MakerBot Replicator 2X.

TROUBLESHOOTING

The Replicator 2X doesn't recognize the SD Card
If your MakerBot Replicator 2X does not detect that there is a card in the SD slot, make sure the SD card is:

- an SDSC card formatted for FAT16
- no larger than 2GB.

Your MakerBot Replicator 2X can read only cards that meet these requirements.

The default SD card that is shipped with your MakerBot Replicator 2X is formatted correctly and is of the correct size.

If the card is formatted correctly but your MakerBot Replicator 2X fails to recognize it, something may be wrong with the card. Contact MakerBot Support.

The Replicator 2X doesn't see the files on the SD Card
If your MakerBot Replicator 2X detects the SD card but can't see the files on the SD card, make sure that each file is in the correct format.

Your MakerBot Replicator 2X can read only files:

- that use the X3G format. To create an X3G file in MakerWare, click Export to File in the make dialog and select X3G from the file type dropdown menu.
- with files name fewer than 26 characters; 30 characters if you count the file extension. If you are trying to print an X3G file with a long file name, shorten it and try again.

The default SD card that is shipped with your MakerBot Replicator 2X contains only files of the correct format and with names less than 26 characters.

If the files are formatted for X3G and the file names have fewer than 26 characters but your MakerBot Replicator 2X fails to recognize them, something may be wrong with the card. Contact MakerBot Support.

Printed objects don't stick to the build plate
If printed objects are not sticking to the build plate, try these solutions:

- Re-level your build plate by going to Utilities > Level Build Plate. Inconsistent plate height will lead to inconsistent adhesion. If any one part of your object does not adhere well to the plate, the whole object might peel off the plate. Try leveling the plate again and using a thinner piece of paper or feeler gauge to check the distance.
- Ensure that the plate is clean. Bubbles, scratches, dust, and oil from your hands can prevent objects from sticking to the Kapton tape. Wipe down the build plate with a clean, lint-free cloth.

6

File Types

This chapter describes the different types of files you will encounter while using your MakerBot Replicator 2X. STLs, OBJs and Things are ways to store 3D models. GCode and X3G are sets of instructions for your MakerBot.

FILE TYPES

STL
An STL is a widely used type of 3D model file. It consists of surfaces made up of triangles. Each triangle has an inner side and an outer side. The outer side is called the normal. In a well-formed STL, all the normals face outwards and the surface is continuous, with no holes. When a model meets these standards, it is referred to as manifold. STLs with normals that face inwards (inverted normals) may be printable, but a manifold model is considered a prerequisite for 3D printing.

STLs are compatible with many different 3D modeling programs and have become the standard file type for 3D printable models. SolidWorks®, Rhinoceros®, and most Autodesk® programs will export STL files, and there are free plugins available that will allow you to export STLs from SketchUp®.

OBJ
An OBJ is another type of 3D model file. It is also used by a number of 3D modeling programs, but is used for 3D printing less often than STL. Unlike STLs, where every facet of your 3D model is a triangle, an OBJ can contain triangles and other polygons. Rhinoceros and some Autodesk programs will export OBJ files, but other programs, including SketchUp and SolidWorks, will require a plugin to export as OBJ.

THING
A Thing file allows you to save build plates in MakerWare. The file includes information about the orientation and position of any 3D model on the plate. The file also allows you to include multiple models on the plate.

When you plate multiple models and save them as an STL, you will no longer be able to move the individual models in relation to each other. When you save multiple models in a Thing file, you can continue to manipulate them individually.

The Thing format works only with MakerWare, so you should not save as Thing if you are saving a file for use with another program.

If you have a Thing file and need to edit the individual STL files, you can change the file extension to .zip, unzip the file and extract the STLs.

GCODE
GCode is a computer language for controlling CNC machines, including many 3D printers. When your slicing software turns your 3D model into a set of instructions for your MakerBot, those instructions are written in GCode. The instructions consist of commands that tell the extruders how hot to get, where to move and when to start extruding plastic, commands that control the build platform and commands for peripheral components, including the LEDs inside your MakerBot.

Before being sent to your MakerBot, MakerWare converts the human-readable GCode to the more compact, computer readable X3G. You can't edit X3G files, but you can edit GCode to do things like change extrusion temperatures and insert extra commands.

MakerWare automatically converts GCode to X3G when sending a file to your printer or saving to an SD card. To view the GCode, open the Make dialog and make sure it is set to **Export to a File**. When the Export dialog appears, select GCode from the dropdown menu at the bottom of the window. You can open your GCode file in any text editor.

To print from saved or edited GCode, go to the MakerWare File menu at the top of the screen and choose **Make from File**... Navigate to the GCode file and choose **Open**. For more details on printing from GCode, see Chapter 8.

X3G
X3G is the compact format in which MakerWare sends instructions to your MakerBot. An earlier version of this format was called S3G. X3G files are currently generated only by MakerWare and ReplicatorG.

NOTES

7

MakerWare

MakerBot MakerWare is software that prepares 3D models for printing and turns them into instructions for your MakerBot Replicator 2X. Using MakerWare, you can prepare OBJ and STL files to be printed. You can also use MakerWare to customize print settings for the objects you make on your Replicator 2X.

DOWNLOADING AND INSTALLING MAKERWARE

Fig. 7.1

1. Go to http://makerbot.com/makerware.

2. Choose your operating system from the platform drop-down menu. [Fig. 7.1]

3. Click the Download button and save the .exe or .dmg file to your local computer.

4. Open the saved file and follow the directions to install the MakerWare software.

NOTE: During Windows installation, a separate installer window will open and prompt you to install device drivers.

TROUBLESHOOTING

Cannot install MakerWare
Perform the installation steps again. If the installation fails a second time, collect as much information on the failure as you can and open a support ticket by emailing support@makerbot.com. MakerBot Support will work with you to diagnose the issue.

Computer displays security warnings during installation
Your operating system may not recognize the drivers MakerWare is installing because they are specific to MakerWare and to your MakerBot Replicator 2X. Click OK to allow the device drivers to install.

SELECTING YOUR MAKERBOT REPLICATOR 2X
If you connect your MakerBot Replicator 2X to your computer before you start MakerWare, MakerWare will automatically detect your MakerBot Replicator 2X. The icon in the lower right corner will display "The Replicator 2X."

If you start MakerWare before you connect your MakerBot Replicator 2X to your computer, MakerWare will display a welcome message and ask you to choose your bot from a dropdown menu. Choose **Replicator 2X** and click **Let's Get Started!**

If MakerWare defaults to the incorrect type of MakerBot 3D printer:

1. Open the MakerBots menu.

2. Choose Type of MakerBot.

3. Choose **The Replicator 2X**.

MakerWare will display settings and options appropriate for the MakerBot Replicator 2X

EXPLORING MAKERWARE

Open MakerWare and take a look around. The following buttons and menus appear:

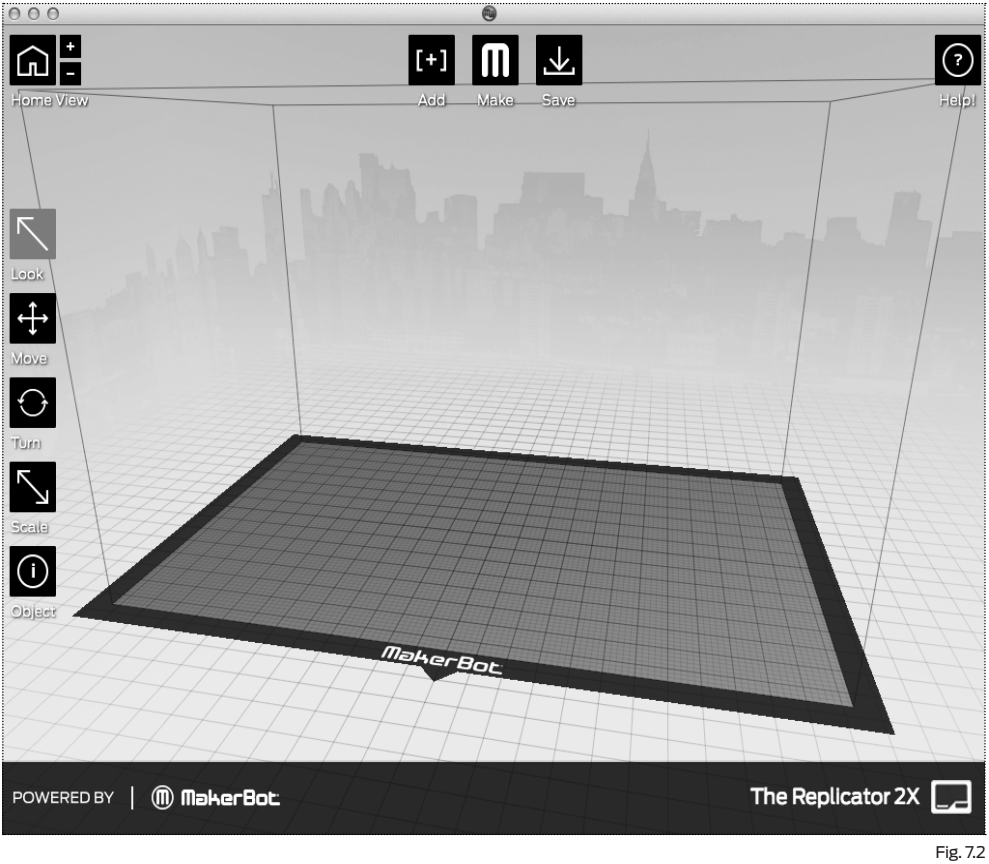


Fig. 7.2

HOME VIEW
Click this button to reset MakerWare to the default view of the build area.

+/-
Click these buttons to zoom in and out. You can also use the scroll wheel on your mouse to zoom in and out.

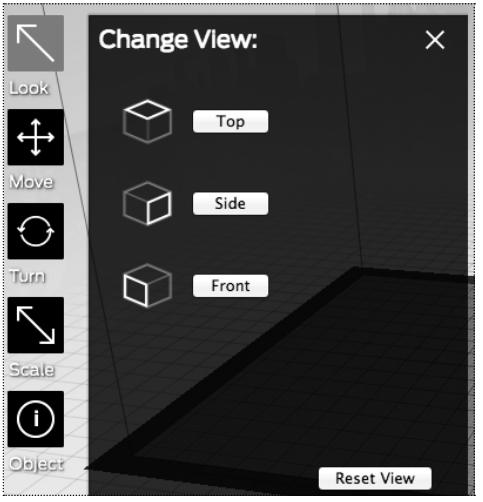


Fig. 7.3

LOOK [Fig. 7.3]
Click the Look button or press the L key to enter Look mode. In Look mode, you can:

- Left-click and drag the mouse to rotate your view of the object.
- Hold down shift, left-click, and drag the mouse to move your view of the object.
- Click on the Look button again or press the L key to view the Change View submenu.

Top: View the object from the top.

Side: View the object from the side.

Front: Default view. View the object from the front side.

Reset View: Returns to the default view.

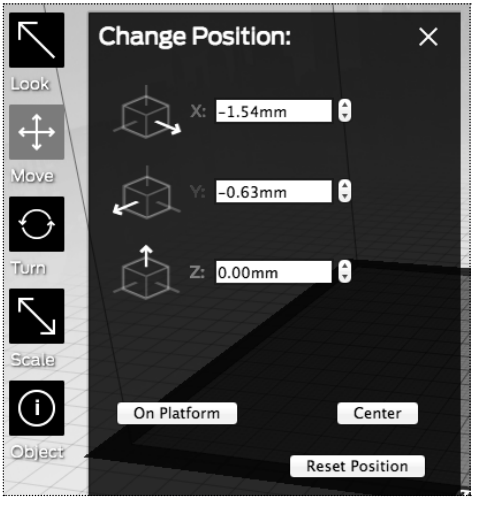


Fig. 7.4

MOVE [Fig. 7.4]
Click the Move button or press the M key to enter Move mode. In Move mode, you can:

- Left-click and drag the mouse to move the object.
- Hold down shift, left-click, and drag the mouse up and down.
- Click the Move button again or press the M key to view the Change Position submenu.

X: Specify position left and right, in millimeters.
Y: Specify position forward and backward, in millimeters.
Z: Specify position up and down, in millimeters.

On Platform: Moves the object to a Z position of 0.00mm.

Center: Centers the object on the build plate.

Reset Position: Returns the object to the last saved position on the build plate.

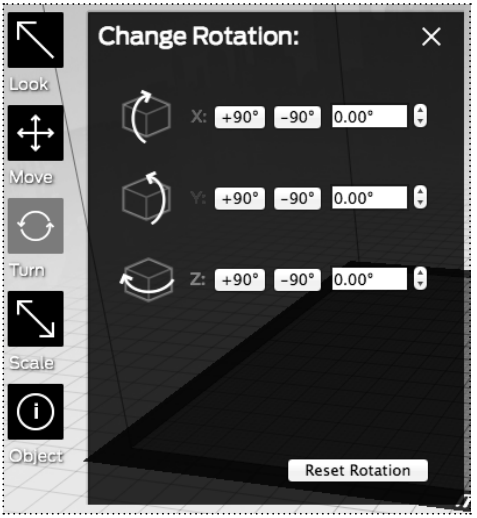


Fig. 7.5

TURN [Fig. 7.5]
Click the Turn button or press the T key to enter Turn mode. In Turn mode, you can:

- Left-click and drag the mouse to rotate the object around (0, 0, 0) the X,Y, and Z-axes.
- Click the Turn button again or press the T key to view the Change Rotation submenu.

X: Specifies rotation around the X-axis, in degrees.
Y: Specifies rotation around the Y-axis, in degrees.
Z: Specifies rotation around the Z-axis, in degrees.

Reset Rotation. Resets the rotation around (0, 0, 0).

Reset Scale. Resets the object to the last saved scale.

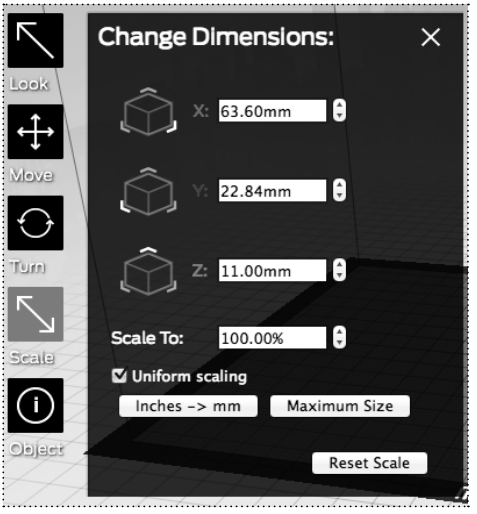


Fig. 7.6

SCALE [Fig. 7.6]
Click the Scale button or press the S key to enter Scale mode. In Scale mode, you can:

- Left-click and drag the mouse to change the scale of the object.
- Click the Scale button again or press the S key to view the Change Dimensions submenu.

X: Specifies size along the X-axis, in millimeters.
Y: Specifies size along the Y-axis, in millimeters.
Z: Specifies size along the Z-axis, in millimeters.

Uniform scaling. Maintains the proportions of the object. If you change a dimension, the other two dimensions maintain their relative size.

Inches -> mm. Converts a model that has been sized in inches to millimeter scale.

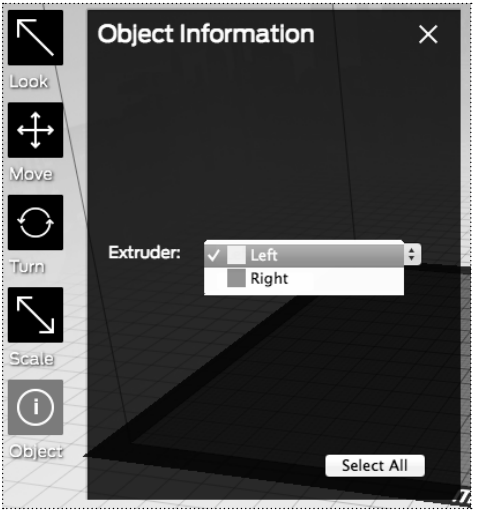


Fig. 7.7

Maximum size. Changes the scale of the object to the maximum that can be printed by the MakerBot Replicator 2X.

Reset Scale. Resets the object to the last saved scale.

OBJECT [Fig. 7.7]
Click twice to open the Object Information submenu. The Object Information submenu allows you to choose which extruder will print each object on your build plate. For details on printing objects with dual extrusion, see the chapter on **Basic Printing**.

ADD
Click this button to add an object to your build plate. When you select the Add button, you can browse for STL and OBJ files on your local computer. You can add as many objects as you can fit on the plate.

MAKE
Click this button to open the Make dialog, where you can specify print resolution and other printing options and save instructions for your MakerBot Replicator 2X to an SD card. For details on the Make dialog, see the chapters on **Intermediate** and **Advanced Printing**.

SAVE
Allows you to save the current plate as a file for later use.

HELP
Opens a guide to MakerWare's basic functions.

STATUS BAR
Displays the status of your connection to your MakerBot Replicator 2X.

MAKERWARE MENUS

FILE
New: Opens a new MakerWare window.

Open: Opens a new object file. If a file is currently open, you will be prompted to save it first.

Add: Adds a new object to the current plate.

Recent: Displays a list of recently opened files.

Examples: Provides a list of example files to print.

Close: Closes MakerWare without saving.

Save: Saves changes to the current plate.

Save As: Saves the current plate as a .thing file or a .stl file.

Export: Saves the current plate as a GCode or .x3g file.

Make: Displays the Make dialog.

Make from File: Prints or exports from .gcode file to X3G file.

EDIT
Undo: Undoes the last action.

Redo: Redoes the last action.

Cut: Cuts object.

Copy: Copies object.

Paste: Pastes object.

Delete: Deletes selected object.

Select All: Selects all objects.

Deselect All: Deselects all objects.

Auto Layout All: Performs auto layout of all objects.

Settings: Opens a menu that allows you to assign a display color to each extruder. On a Mac, access this menu by going to MakerWare > Preferences.

VIEW
Home View: Displays a view of the front and top of the object.

Top View: Displays a view of the top of the object.

Side View: Displays a view of the right side of the object.

Front View: Displays a view of the front of the object.

MAKERBOTS
Upload Firmware: Checks for the latest version of the firmware. Prompts you to upload the latest if the firmware is out of date.

Onboard Preferences: Allows you to change the default settings for the MakerBot Replicator 2X. For advanced users.

Type of MakerBot: Allows you to specify the type of MakerBot Replicator you are using during the session.

SERVICES
Stop Background Service:Stops Conveyor, the service that manages print jobs and connections to the MakerBot Replicator 2X.

Start Background Service: Starts Conveyor, the service that manages print jobs and connections to the MakerBot Replicator 2X.

Show Background Service Log: Displays a log file for the current Conveyor session.

HELP
Quick Help: Opens a guide to MakerWare's basic functions.

Online Help: Displays information from the MakerBot website.

SHORTCUT KEYS

SELECTING AN OBJECT

- To select a single object, left-click with the mouse.
- To select two objects, select one object, hold down the Shift key and select the other object. Release the Shift key.
- To select multiple objects, select one object by clicking with the left mouse button, hold down the Shift key, select additional objects, and release the Shift key.

SHORTCUT KEYS

L	Enters Look mode
M	Enters Move mode
T	Enters Turn mode
S	Enters Scale mode
O	Enters Object mode
Ctrl/Cmd +N	Opens an additional MakerWare window
Ctrl/Cmd + O	Opens a new object file. If a file is currently open, you will be prompted to save it first
Ctrl +F4 (Windows) Command+Q (Mac)	Closes MakerWare
Ctrl/Cmd +S	Saves the current plate
Ctrl/Cmd +P	Displays the Make dialog
Ctrl/Cmd +Alt+P	Displays the Make From File window
Ctrl/Cmd +Z	Undoes last action
Ctrl +Y (Windows) Command+Shift+Z (Mac)	Redoes last action
Ctrl/Cmd +X	Cuts object
Ctrl/Cmd +C	Copies object
Ctrl/Cmd+V	Pastes object
Ctrl/Cmd+D	Duplicates selected object
Delete	Deletes object
Ctrl/Cmd+A	Selects all objects
Ctrl/Cmd+Shift+A	Deselects all objects
Ctrl/Cmd+L	Performs auto layout of all objects
Ctrl/Cmd+1	Returns to Home view

TROUBLESHOOTING

MakerWare cannot detect my MakerBot Replicator 2X

When MakerWare cannot connect to the MakerBot Replicator 2X, that usually means you have to restart Conveyor. Conveyor is a background service that runs as part of MakerWare and manages the connection to your MakerBot Replicator 2X.

To restart Conveyor:

1. Go the Services menu.
2. Choose Restart Background Service.
3. If Conveyor was the cause of the problem, you should now see the Replicator 2X icon at the lower right of the MakerWare window.

8

Preparing to Print

MakerWare allows you to open files, resize objects, create new object files, and save those files in multiple formats. This chapter will describe how to perform these tasks.

DOWNLOADING FILES

FILE FORMATS FOR MAKERWARE
MakerWare can open the following file types:

- OBJ
- STL
- THING

MakerWare can save the following file types:

- STL
- THING

MakerWare can export to the following file types:

- GCode
- X3G
- S3G

For details on file types, see the chapter titled "File Types."

Minimalist NYC buildings
Search
Advanced Search
Showing things containing the words: Minimalist NYC buildings
Search Results (1 thing)
Minimalist NYC buildings by JonMonaghan
I can't take all the credit, many of them were based on google earth/warehouse models. But here they are fixed up and ready to print.
Published: Oct 21, 2011 on Oct 21, 2011
License: Public Domain

Fig. 8.1

Fig. 8. 2

DOWNLOADING A FILE FROM THINGIVERSE
To import a file from Thingiverse into MakerWare, you must first save the file to your local computer. In this example, we will import two files from Thingiverse: FlatIron.stl and Woolworth.stl. To do this:

1. Open a browser session and go to http://www.thingiverse.com.

2. If you know the name of the file you want to import, you can use the Search field in the upper right of the page. Use the search field at the upper right to search for "Minimalist NYC buildings." Your search results should include "Minimalist NYC buildings by JonMonaghan." Click on the link. [Fig. 8.1]

3. At the right of the page you will see a button that says "Download This Thing!" [Fig. 8.2] Click this button to open the Downloads window.

4. For this example we chose the Flatiron Building and the Woolworth Building. In the Downloads window, find FlatIron.stl and Woolworth.stl and click the file names to save them to your computer.

IMPORTING AND MOVING OBJECTS

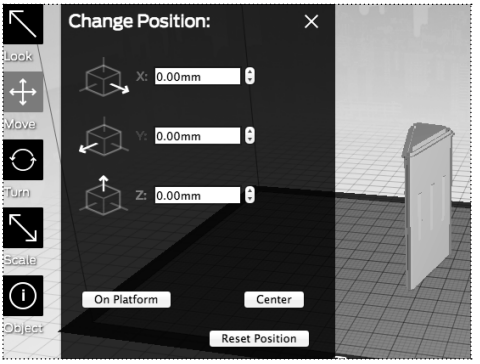


Fig. 8. 3

The files FlatIron.stl and Woolworth.stl are now ready to be opened in MakerWare. The following examples will make use of these two files.

IMPORTING A FILE FROM A MODELING APPLICATION
To import a file from a 3D modeling application into MakerWare:

1. In the 3D modeling application, save the file as either a binary STL file, an ASCII STL file, or an OBJ file.

2. Start MakerWare. Choose the File menu. Choose Open. Navigate to the directory where you stored the file from the 3D modeling application.

3. Select the file and click Open to open the file in MakerWare.

MOVING AN OBJECT [Fig. 8.3]
In this section, we will open a file and move the object.

1. Start MakerWare. Choose the File menu. Choose Open. Navigate to the directory where you stored FlatIron.stl. Select this file to open it.

The Flatiron model appears in the middle of the plate in MakerWare.

2. To move the model around on the plate:

- Click on the Move button.
- Hold down the left mouse button and drag left, right, forward, and back.
- Hold down shift and the left mouse button and drag up and down
- Click on the Move button again or press the M key to view the Change Position submenu.

COPYING OBJECTS

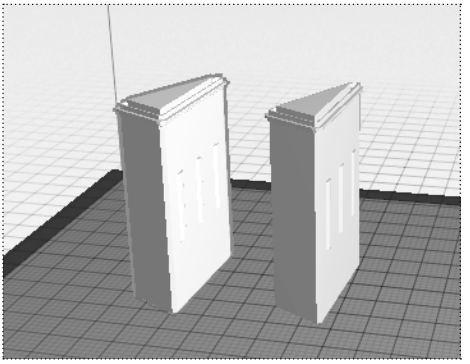


Fig. 8. 4

3. To prepare for the next section, move the Flatiron model to the left side of the build plate.

DUPLICATING OBJECTS [Fig. 8.4]
In this section, we will copy an object.

Currently, you should have the Flatiron model at the left side of your build plate. We will make a copy of the Flatiron model. To do this:

1. Click on the Flatiron model. A yellow outline will surround the object.

2. Press the keys Ctrl+C or Command+C to copy the file.

3. Press the keys Ctrl+V or Command+V to paste a copy of the file onto the plate. The copy of the Flatiron model will appear right next to the original.

4. Press the keys Ctrl+Z or Command+Z to undo your last action and remove the copy of the Flatiron model.

ADDING AND SCALING OBJECTS

ADDING AN OBJECT TO THE PLATE
In this section, we will add a second object to the plate.

Currently, you should have the Flatiron model at the left side of your build plate.

1. Click the Add button.

2. Navigate to the location of the file Woolworth.stl and select that file.

Now you should see both the Flatiron Building and the Woolworth Building models on the plate in MakerWare.

You can manipulate the models on the plate separately or together.

MANIPULATING MULTIPLE OBJECTS
1. To manipulate one object, select only that object. For example:

- Select the Flatiron model.
- Click the Turn button.
- Hold down the left mouse button and use your mouse to rotate the object. Notice that only the selected object, the Flatiron Building model, rotates.

2. If you select more than one object, you can apply the Move function, Turn function or Scale function to those objects simultaneously. For example:

- Select the Flatiron Building.
- Hold down the Shift key and select the Woolworth Building. Then release the Shift key. Both models should be selected.
- Select the Turn button.
- Hold down the left mouse button and drag to rotate the models. Notice that both objects rotate.

SCALING AN OBJECT
In this section, we will scale our two models.

Currently, you should have the Flatiron and Woolworth models on your plate.

1. Select the Flatiron model.

2. To scale the Flatiron model:

- Click the Scale button.
- Hold down the left mouse button and drag to change the scale of the object.
- Click on the Scale button a second time or press the S key to view the Change Dimensions submenu.

3. Click Reset Scale to return the Flatiron model to its original scale.

4. Select the Flatiron model, hold down the Shift key and then select the Woolworth model. Both objects should now be selected.

5. Use the Scale button to change the scale. Notice that both objects are re-scaled simultaneously, while maintaining the relative scale.

SAVING AND PRINTING A FILE

SAVING YOUR MODEL AND TOOLPATH FILES

To save an object or a plate with multiple objects, click the Save button.

The Save dialog gives you the option to save the contents of the build plate as an STL or Thing file.

- If you want to open the file in an application other than MakerWare, you should save the file as an STL file. If you save as an STL file, you can no longer manipulate each object separately in MakerWare.
- If you save as a Thing file, you will be able to open the file in MakerWare and manipulate each object independently. However, Thing files can be opened only with MakerWare.

NOTE: You can always change the file type by opening the file in MakerWare and saving it again as a different file type.

PRINTING YOUR FILE

1. Insert your SD card into an SD card reader attached to your computer.

2 . Click the Make button.

3. Accept the default settings and click the Export! Button. MakerWare will open the Export dialog.

4. Set the following options in the Export dialog:

   - Navigate to the location of your SD card and select it.
   - Enter “flatiron_woolworth” as the file name.
   - Ensure that X3G is selected from the file type dropdown menu.

5. Click Save.

6. Eject your SD card from your computer’s SD card reader and insert it into the SD card port behind the MakerBot Replicator 2X’s LCD interface.

7. Use the arrow buttons on the LCD interface’s keypad to navigate to “Build from SD”. Press the M button to view the list of files available on your SD card.

8. Use the arrow buttons to navigate to the file flatiron_woolworth.x3g. Press the M button to build the selected file. Your MakerBot Replicator 2X will use the toolpath you created to build your model.

9

Basic Printing

This chapter will walk you through printing two objects using the default settings in MakerWare. It will also walk you through the steps to print a dual extrusion object.

This chapter assumes you have already downloaded and installed MakerBot MakerWare. If you have not installed MakerWare yet, see the chapter on **Installing MakerWare**.

PRINTING EXAMPLES

PRINTING THE TREE FROG

To print this tree frog model, we will download the STL file from Thingiverse and then open and print the file with MakerWare. It is a simple design and does not need any adjustments made to it in MakerWare.

1. Open a browser session and go to http://www.thingiverse.com.

2. In the Search field in the upper right of the page, enter “treefrog”.

3. In the Search Result page, find Treefrog by MorenaP. Click on the title link.

4. On the Thing page for the tree frog model, you will see a button that says Download This Thing! Click this button.

5. In the Downloads window, in the Filename pane, select the file treefrog_45_cut.stl. Thingiverse will download the file to your local computer.

6. Start MakerWare. Choose the File menu. Choose Open. Navigate to the directory where you stored the file treefrog_45_cut.stl. The tree frog should appear in MakerWare.

7. Click the Make button.

8. In the Make dialog, select the Export to File radio button. [Fig. 9.1]

9. Click the Export! button. A dialog box will open asking you to save the STL file. Ensure that you have chosen X3G in the file type drop-down menu. Save the file to an SD card.

10. Eject the SD card from your computer and insert it into the SD port on your MakerBot Replicator 2X. Choose **Build From SD** from the LCD menu, and select the Tree Frog.

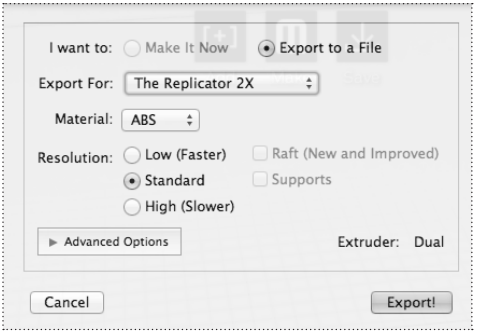


Fig. 9.1

PRINTING THE OWL STATUE

To print this owl model, we will download the STL file from Thingiverse and then open and print the file with MakerWare.

The default size of this model is quite large, so we will make use of the scaling feature to resize it. Scaling down the owl model will also reduce the printing time.

1. Open a browser session and go to http://www.thingiverse.com.

2. In the Search field in the upper right of the page, enter “Owl statue”.

3. In the Search Result page, find Owl statue by cushwa. Click on the title link.

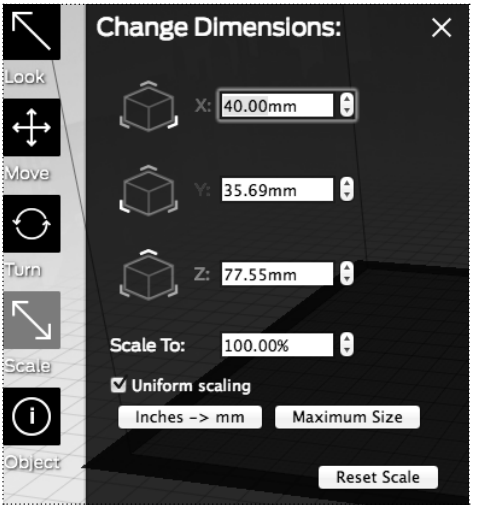


Fig. 9.2

4. On the Thing page for the Owl statue, you will see a button that says Download This Thing! Click this button.

5. In the Downloads window, select the button Download All Files. Thingiverse will download the file OwlReDo1_fixed_sc.stl to your local computer.

6. Start MakerWare. Choose the File menu. Choose Open. Navigate to the directory where you stored the file OwlReDo1_fixed_sc.stl. The owl should appear in MakerWare.

7. Click the Scale button twice. In the Change Dimensions dialog, edit the following settings:

Uniform scaling: Ensure that this checkbox is selected.

X: Set this field to 40.00mm. [Fig. 9.2]

8. To save your changes, go to the File menu and choose Save.

9. Choose the File menu and choose Make or click the Make button.

10. In the Make dialog box, select the Export to a File radio button.

11. In the Make dialog box, click the Export! button. Save your STL file to an SD card.

PRINTING A DUAL EXTRUSION OBJECT

Dual extrusion models are composed of two STL files sliced to a single X3G file where one of the STL files will be printed by the left extruder, and the other STL file will be printed by the right extruder.

PRINTING WITH BOTH EXTRUDERS

Put object on platform?
This object is off the platform. Do you want to put it on the platform?
Keep Position
Move to Platform

Fig. 9.3

To better understand how dual extrusion works, we will download a dual extrusion object from thingiverse.

1. Open a browser session and go to http://www.thingiverse.com.

2. In the Search field in the upper right of the page, enter “Lotus Flower”.

3. In the Search Result page, find Lotus Flower by rweaving. Click on the title link.

4. In the Thing page for the Lotus flower, you will see a button that says Download This Thing! Click this button.

5. In the Downloads dialog box, select the button Download All Files. Thingiverse will download the files Lotus_color1.stl and Lotus_color2.stl to your local computer.

6. Start MakerWare. Ensure you have Replicator 2X selected. To do this:

- Go to the MakerBots menu.
- Choose Type of MakerBot.
- Choose The Replicator 2X.

7. Choose the File menu. Choose Open. Navigate to the directory where you stored the file Lotus_color1.stl . The Lotus Flower should appear on the plate in MakerWare.

8. Click the Add button. Navigate to where you stored the file Lotus_color2.stl.

9. MakerWare displays a dialog asking “This object is off the platform. Do you want to put it on the platform?”. Select “Keep Position”. MakerWare will position the new object on top of the existing object. [Fig. 9.3]

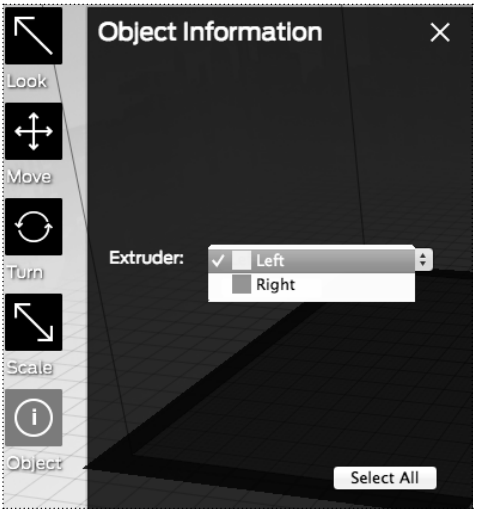


Fig. 9.4

10. Click on the point of an outer petal from the first layer to highlight that object.

11. Click twice on the Object button.

12. In the Object Information submenu, in the Extruder field, select an extruder to print Lotus_color1.stl. [Fig. 9.4]

13. Click on the point of an outer petal from the second layer to highlight that object.

14. Click twice on the Object button.

15. In the Object Information submenu, in the Extruder field, select an extruder to print Lotus_color2.stl.

16. To keep the two STL files linked together and assigned to extruders, save the object as a .thing file. To do this:

- In the File menu, choose Save As.
- Save the file as a .thing file.

17. Choose the File menu and choose Make It or click the Make button.

18. In the Make dialog box, select the Export to a File radio button.

19. In the Make dialog box, click the Export! button. Save your STL file to an SD card.

NOTES

10

Intermediate Printing

This chapter is for users who are ready to start editing print settings in MakerWare instead of accepting the default settings. It will explain when and how to use helper disks with a print, when and how to use rafts and support with a print, and how to use the print quality settings in the Make dialog in MakerWare.

PRINT QUALITY

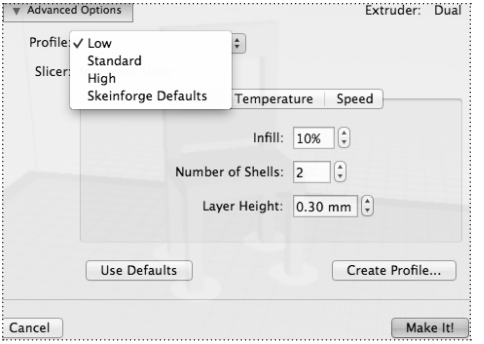


Fig. 10.1

Quality	Infill	Number of Shells	Layer Height
Low	10%	2	0.30 mm
Standard	10%	2	0.20 mm
High	15%	2	0.10 mm

Fig. 10.2

PRINT QUALITY
In MakerWare, when you select the Make command or Make button, you can specify one of three preset printing profiles. [Fig 10.1] Your choices are:

- **Low**. Prints an object with lower resolution, but with a shorter print time.
- **Standard**. Prints an object with standard resolution.
- **High**. Prints an object with higher resolution, but with a longer print time.

The setting that most affects print quality is layer height. The preset layer heights in MakerWare range in size from 0.10 mm to 0.30 mm. The thinner the layer, the more layers per millimeter and the smoother the texture of your printed object.

The Low, Standard and High profiles in MakerWare support and optimize different layer heights. [Fig 10.2] When you select a printing profile in the Make dialog, you are choosing both a layer height and a slicing profile that will work best with the selected level of resolution. For more on slicing profiles, see http://www.makerbot.com/support/makerware/documentation/slicer/.

File Name: 3D mouse
Design by: DDStarkey
Thingiverse: 61909

Fig. 10.3

RAFTS

A raft is a flat base that is printed before the object. A raft can help your object stick securely to the build plate. [Fig 10.3]

In MakerWare, when you select the Make command or Make button, you can check a box in the Make dialog to include a raft with your print.

A raft consists of several layers forming a flat surface for your object to rest on. Objects printed with rafts sit on this base of disposable material instead of directly on the build surface. If your build plate is uneven or has imperfections, the raft might provide a better build surface. The base layer of the raft is thicker than a regular layer and prints more slowly, so it adheres better to the build plate.

NOTE: MakerBot recommends that you include a raft for best results when printing with support. Support structures might not adhere well to the build plate without a raft.

To print an object with a raft:

1. Open MakerWare. Open the model you want to print.

2. Click the Make button or open the File menu and choose Make It.

3. In the Make dialog, make sure the Raft box is checked.

4. Print the object as usual.

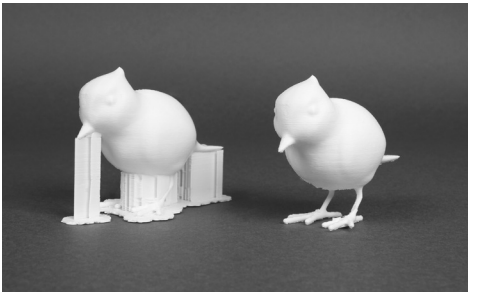
SUPPORTS

The Raft Won't Come Off My Object
If you can't easily remove the raft from your object, try these solutions:

- Create or edit a custom profile using the MakerBot Slicer and increase the "raftModelSpacing" setting by .1 mm. This will increase the separation between the raft and the model.
- Create or edit a custom profile using the MakerBot Slicer and increase the "feedstockMultiplier" by .05 mm. The raft might be difficult to remove because too much plastic is being extruded. Changing this setting will slightly decrease the amount of plastic extruded.

For information on creating and editing custom profiles, see our online documentation at makerbot.com/support/makerware/documentation/slicer.

SUPPORTS



File Name: Bird (for putting on things) Fig. 10.4
Design by: scintilla
Thingiverse: 76469

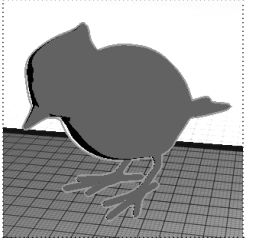


Fig. 10.5

In MakerWare, when you select the Make command or Make button, you can check a box in the Make dialog to specify whether your object will include automatically generated support structures.

Supports allow you to print overhanging parts. Because the MakerBot Replicator 2X cannot print into thin air, supports provide a base for overhanging parts of a model. You can easily remove supports after building the object.

For an example, look at this bird model designed by Scintilla. [Fig 10.4]

The thin legs provide almost no support for the body, so it will not print correctly without added support material.

Remove support material by tearing it away with a pair of pliers or your fingers. Supports can leave surface imperfections that require finishing of the object. For details on finishing an object, see the chapter titled "Finishing Things".

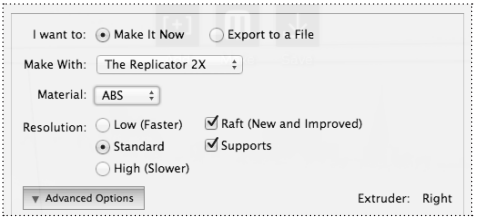


Fig. 10.6

To print an object with supports:

1. Open MakerWare. Open the model you want to print.

2. Click the Make button or open the File menu and choose Make It.

3. In the Make dialog, ensure that the following boxes are checked:

Raft: Select this checkbox to print your object on top of a raft.

Supports: Select this checkbox to print your object with supports. [Fig 10.6]

4. Print the object as usual.

TROUBLESHOOTING

The Supports Won't Come Off My Object

- Create or edit a custom profile using the MakerBot Slicer and increase the "supportMargin" setting by .1 mm. This will increase the separation between the support structures and the model.
- Create or edit a custom profile using the MakerBot Slicer and increase the "feedstockMultiplier" by .05 mm. The supports might be difficult to remove because too much plastic is being extruded. Changing this setting will slightly decrease the amount of plastic extruded.

PRINTING AN EXAMPLE

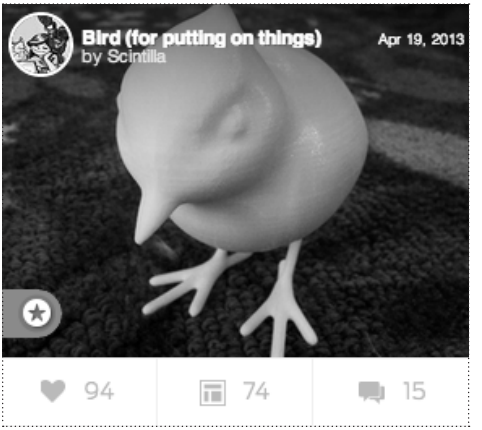


Fig. 10.7

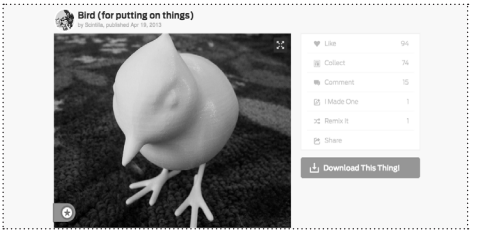


Fig. 10.8

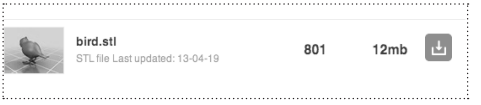


Fig. 10.9

In this example, we will print the bird model shown earlier. To do this:

1. Open a browser session and go to http://www.thingiverse.com.

2. In the Search field in the upper right of the page, enter “Bird (for putting on things)”.

3. In the Search Result page, find Bird (for putting on things). Click on the title link.

4. In the Thing page for the bird, you will see a button that says Download This Thing! Click this button.

5. In the Downloads window, click on the file bird.stl. Thingiverse will download the file to your local computer.

6. Start MakerWare. Choose the File menu. Choose Open. Navigate to the directory where you stored the file bird.stl.

7. The bird statue should appear in MakerWare.

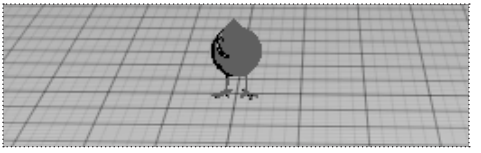


Fig. 10.11

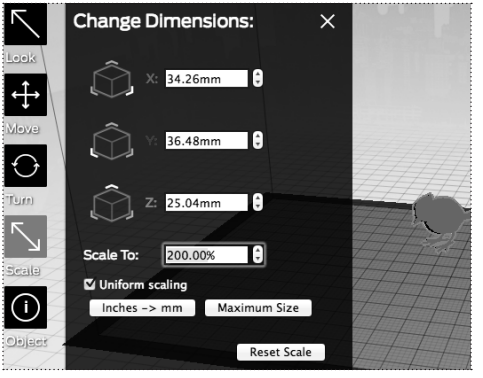


Fig. 10.12

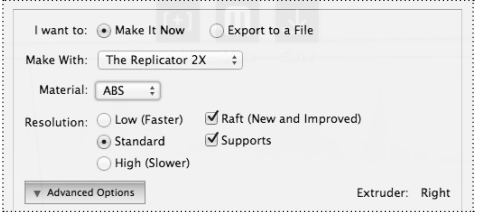


Fig. 10.13

8. The default size of the bird is very small. We will resize the object to increase its size. [Fig 10.11]

9. Click the Scale button twice. In the Change Dimensions menu, edit the following settings [Fig 10.12]:

Uniform scaling. Ensure that this box is checked.

Scale To. Set this field to 200.00%

10. Click the Make button or choose the File menu and choose Make It.

11. In the Make dialog, ensure that the following boxes are checked [Fig 10.13]:

Raft. Select this checkbox to print your object on top of a raft.

Supports. Select this checkbox to print your object with supports.

12. Print the object as usual.

NOTES

11

Advanced Printing

This chapter describes the advanced printing options in the MakerWare software.

PRINT QUALITY

ADVANCED OPTIONS
To use the settings under **Advanced Options**, you must select one of MakerWare's base profiles (Low, Standard, or High). When you change any of the settings in **Advanced Options**, an asterisk will appear next to the profile name everywhere it appears in the Make dialog. The asterisk indicates that the base profile is no longer in its default state.

NOTE: The settings in Advanced Options never edit the base profiles; they only override them. MakerWare will save the set of overrides for you, but you can always return the profile to its original state by clicking the Use Defaults button at the lower left of the Advanced Options area.

These options provide control over specific slicing options. To access the advanced options, click the **Advanced Options** button at the lower left of the Make dialog. This button toggles the visibility of the advanced options, which are grouped into three tabs : **Quality**, **Temperature** and **Speed**.

To change a setting in the **Advanced Options** tabs, highlight the current number and enter a new one.

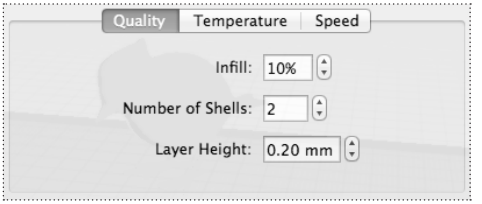
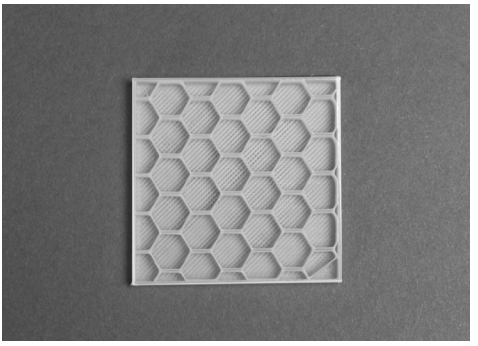


Fig. 11.1

QUALITY [Fig. 11.1]
The settings in the **Quality** tab affect the strength and finish of printed objects. Each Quality option affects particular sections of an object and requires some understanding of the composition of a 3D printed object.

The MakerBot Replicator 2X begins printing your object by putting down several solid layers. These initial layers are called the floor of the object. If your object has a flat top, or a section with a flat top, your MakerBot Replicator 2X will print a similar set of solid layers there. This top is called a roof.

The MakerBot Replicator 2X starts each new layer of an object by printing some number of outlines of that layer. These are called shells. If there is more than one shell, the additional shells will be nested inside the first one.



File Name: 20mm calibration box Fig. 11.2
Design by: Spacexula
Thingiverse: 2064

Infill. Everything that is neither shells, nor floor, nor roof is filled with an internal lattice called infill. [Fig. 11.2] Infill provides your object with an internal support structure. The number that you enter in this field defines the solidity of the printed object's infill. Higher infill percentages will result in more threads of infill extrusion that are closer together. Lower infill percentages will result in fewer threads of infill extrusion that are more widely spaced. For a hollow object with no internal support structure, enter an infill of 0%. For a completely solid object, enter 100%.

For decorative objects, you might want to set a low infill percentage--maybe 5 or 10%. If you are having trouble with the upper surfaces of your object, you might want to raise that number. Flat roofs must have some structure underneath them so that they do not sag. Rounded objects might show gaps if there is not enough infill for the shells of new layers to adhere to.

More infill will increase the strength and weight of your object. It will also increase the printing time for the object. For objects with a practical purpose, you should use more infill. An infill of 40 or 50% usually results in a robust object, but if you are able to crush or break your object, try raising the amount of infill by 10%.

File Name: Rock Wall hold 1.0 Fig. 11. 3
Design by: Jeremy007007
Thingiverse: 34331

Shells. Every object you print must have at least one shell. You can add as many shells as you want and they will print as concentric perimeters on each layer. [Fig. 11.3] If the layer cannot accommodate the specified number of shells, the slicer will just fit in as many as possible.

Additional shells, like larger amounts of infill, add to an object's strength, weight, and print time. Two or three shells are sufficient for most objects. Additional shells might help if you see cracks between the layers of your object.

Layer Height. Layer height determines the thinness of each printed layer of your object. It is often treated as a measure of resolution in 3D printing, but it affects resolution only on the Z-axis (up and down).

Thinner layers will result in a smoother surface, but will also increase print times; layers take the same time to print regardless of height and thinner layers increase the total number of layers to be printed.

The preset layer heights for the MakerBot Replicator 2X range from .10 mm to .30 mm. Layers thicker than .34 mm are difficult because the extruded plastic noodle emerging from the nozzle is only .4 mm in diameter. When the distance between one layer and the next approaches the height of the noodle, the two layers will not be pressed closely together and might not stick to each other very well.

Layers thinner than .10 mm are possible, but present additional challenges. Smaller layers require the plate to be trammed more closely to the extruders. Ideally, the distance between your extruder nozzles and build plate should be one half of your layer height.

TEMPERATURE

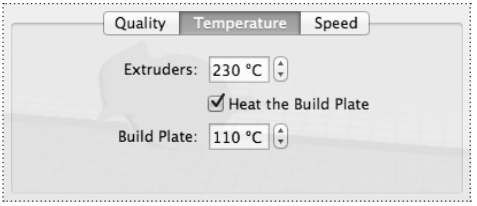


Fig. 11. 4

TEMPERATURE [Fig. 11.4]
Temperature settings for the extruders and the build plate are grouped together under the Temperature tab.

Extruders. The extruders will need to be heated to approximately 230º C to melt and extrude the plastic filament at normal operating speeds. Extrusion temperature is tied very closely to both extrusion speed and the material being extruded. If you are experimenting with either of those, you might need to experiment with extrusion temperature, too.

Speed. Higher extrusion speeds require higher temperatures. During printing, plastic filament passes into the extruder where it is melted before being squeezed out onto the build plate. When the plastic melts, heat moves from the extruder's thermal core into the plastic, heating the plastic and cooling the extruder. The heater sends heat to the extruder to maintain the temperature required to melt the plastic, but when the plastic moves faster, it pulls heat out of the extruder faster, too.

If you are experimenting with extrusion speeds faster than the standard 80 mm/s you might have to raise your extruder temperature, too. And if you are printing slower than the standard 80 mm/s, you might want to lower the extruder temperature below the standard 230º C.

Material . Different kinds of plastic have different melting points. ABS needs more heat to melt than PLA, for example, and PVA needs less. At higher speeds the temperature required to keep the extruder hot can even this out, which is why 230º C is a good extrusion temperature for both ABS and PLA.

TEMPERATURE CONTINUED

If you are experimenting with different materials or extrusion rates, you need to consider the properties of the material you are using. Additives in plastic, including coloring agents, can also affect a particular filament's properties, so if you are having trouble with a new roll of filament, temperature might be the culprit.

Build Plate. A heated build plate helps printed plastic objects to stick to the printing surface without warping. If prints are not adhering to your build plate, and you have tried cleaning and releveling, try raising the plate temperature a few degrees.

ABS adheres best at temperatures between 100° and 115° C. If you adjust the plate temperature to 115° C and continue to have adhesion problems, the problem probably lies elsewhere.

PLA is much less likely to warp, and tends to work well on an unheated build plate, but having a heated plate can improve large PLA prints by relaxing the bottom layers. Temperatures in the 40° to 60° C range work well with PLA. The material of the printing surface is also a factor here. PLA sticks well to blue tape at much lower temperatures, but will not stick well to Kapton tape even at high temperatures.

SPEED

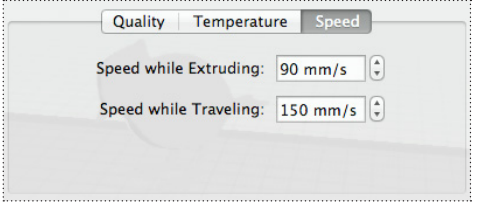


Fig. 11.5

SPEED [Fig. 11.5]
Everyone wants their MakerBot to move faster so they can print things more quickly. Our default print speed is 80 mm/s, and if you want to print faster, you might have to adjust more settings than the extrusion speed. Print speeds are closely tied to temperature settings and to the mechanical capabilities of your MakerBot.

Speed while Extruding. Speed while Extruding controls two things: the speed at which the extruder is moving while printing and the speed at which plastic is coming out of the nozzle. These speeds are the same because that makes for the most even extrusion.

Because moving filament through the extruder at higher speeds pulls heat out of the extruder more quickly, substantial increases in speed require increases in extrusion temperatures. MakerBot does not recommend extruder speeds higher than 120 mm/s.

Speed while Traveling. Traveling is when the extruder moves without extruding filament. Because travel moves are not limited by the temperature at which the plastic can be extruded, they can be faster than moves that do include extrusion.

CUSTOM PROFILES

Additional advanced options are available through Custom Profiles. Custom profiles allow you to edit the slicing engine's profile settings directly instead of overriding them by using the Advanced Options settings. For more information on using custom profiles, see http://www.makerbot.com/support/makerware/.

NOTES

12

Introduction to Thingiverse

Thingiverse is a website created by MakerBot. You can access the website at http://www.thingiverse.com. Thingiverse allows MakerBot users and others to share design files for 3D objects. You can download files from Thingiverse and print them on your MakerBot Replicator 2X. You can also upload your own original designs to Thingiverse for others to print. Thingiverse is always changing, so visit thingiverse.com regularly to check out new features.

This chapter explains how to navigate Thingiverse, find objects to download and interact with other users.

THINGIVERSE

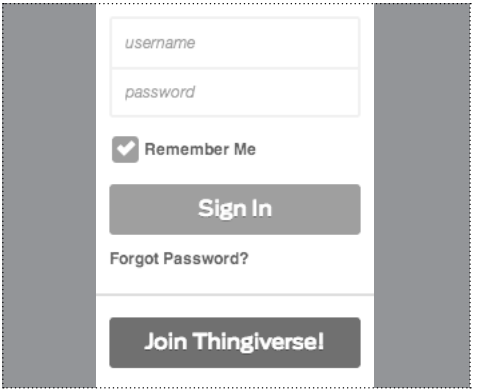


Fig. 12.1

Fig. 12.2

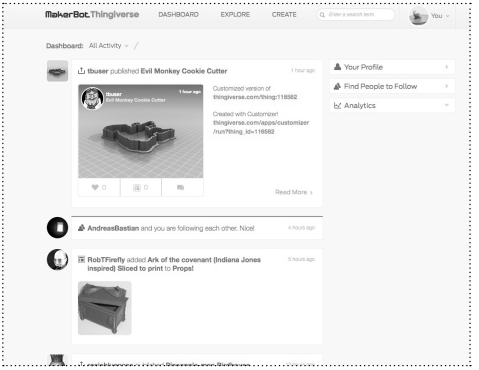


Fig. 12.3

CREATING AN ACCOUNT [Fig. 12.1]
To create a Thingiverse account, click the Join Thingiverse button at the top right of any Thingiverse page. With a Thingiverse account you can:

- Access the Dashboard
- Publish Things
- Customize Things
- Like and Collect Things
- Follow other Users
- Launch Apps

NAVIGATING THINGIVERSE
To view the Thingiverse website, go to http://www.thingiverse.com

The links in the top navigation bar will allow you to reach different areas of Thingiverse:

Dashboard. [Fig. 12.2] After you create an account on Thingiverse, the Dashboard allows you to view a one-page overview of your uploads on Thingiverse (for example, the number of other users who downloaded your designs) for the last 30 days and the activity associated with any Thingiverse users you have chosen to follow. [Fig. 12.3] If you are not logged into Thingiverse, clicking the Dashboard link will take you to a Sign In screen.

Explore. Allows you to find Things in a number of different ways. You can:

- Sort by New and Noteworthy, Featured, Popular and Recently Made, see only Remixed or Customizable objects, view a random selection of objects, or go to The Firehose for an unfiltered view of all new objects.
- View Collections of Things curated by other users.

Fig. 12. 4

Downloads
Minimalist NYC buildings
created by JonMonaghan
Download All Files
Minimalist_NYC_buildings.zip, 315 kb
By downloading this thing, you agree to abide by the license: Public Domain

Fig. 12. 5

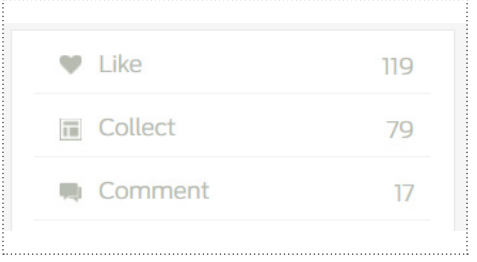


Fig. 12. 6

- Browse all Things by Categories like Tools, Household, and Art.
- View Apps created using the Thingiverse API.

Create. Allows you to publish your own Things, create objects using the Customizer, start a Collection of other users' Things, or publish an App using the Thingiverse API.

Search. Allows you to search Thingiverse using simple text matching.

THE THING PAGE

When you find a Thing to make, click on the image or name of the Thing to go to the Thing page. [Fig. 12.4] On the Thing page you can get more information about the Thing, download files to make the Thing, and give feedback to the user who uploaded the Thing.

To download a Thing:

Click on the Download This Thing! button at the right of the page to open the Downloads window. The Downloads window includes a Download All Files button, which will download any files associated with the Thing as a ZIP file. [Fig. 12.5] It also includes a list of all the files associated with the Thing, which can be downloaded individually.

To show that you Like a Thing:

If you like something that someone has uploaded to Thingiverse, let them know! The Like button is a heart icon at the upper right, above icons that allow you to add a Thing to a Collection, or make a comment. [Fig. 12.6]

Fig. 12. 7

Fig. 12. 8

To show that you Made a Thing:
When you print something downloaded from Thingiverse, it's good manners to show your work.

- Click the "I made one!" button in the right sidebar. [Fig. 12.7]
- This will take you to a new page where you can upload an image and add a description of the Thing you made.
- Click Create at the lower right corner of the page to save the record of your Made thing.

To Follow a user:
If you admire another Thingiverse user and want to know when they publish new designs, add Things to a Collection, or have a Thing featured on the front page, Follow them. You can find the Follow button on any Thing page, to the right of the Thing image and directly underneath the name of the user who published the Thing. [Fig. 12.8]

13

Using the Customizer in Thingiverse

Customizer is an application available on thingiverse.com. Customizer allows users to change the parameters of an object before downloading the STL file and printing it.

Customizer allows users to make changes to an object directly from Thingiverse, using an intuitive user interface. When a user clicks the Create Thing button, Customizer saves the user's changes and creates an STL file that the user can download and print.

This chapter will explain how to customize and download an object using Customizer.

CUSTOMIZING A THING

Fig. 13.1

VIEWING CUSTOMIZABLE THINGS
To view a list of Things that you can customize with the Customizer application:

1. Go to http://www.thingiverse.com.

2. On the home page, click the Explore link at the top of the page and then click Customizable Things.

3. Thingiverse will display the Customizable page, with a list of Things that you can customize with the Customizer application.

Each customizable Thing has a set of parameters you can edit in Thingiverse. These parameters are created by the user who uploaded the Thing. To view and manipulate a customizable Thing:

1. Find the thing, either through the Search tool or by viewing the list of Customizable Things. Go to its Thing page.

2. In the Thing page, select the button Open in Customizer. [Fig. 13.1]

3. You can now view the list of customizable parameters for the thing.

Fig. 13.2

SAVING AND DOWNLOADING YOUR CUSTOMIZATIONS

After you change one or more parameters for a customizable thing, you can save your customizations and download the file for printing. To do this:

1. In the Customizer page, click the Create Thing button.

2. The Creating Your Customized STL dialog box appears. You can enter values in the following fields:

Name: Name of the file for the customized thing.

Publish New Thing: Select this checkbox to publish the STL file to Thingiverse.

Email me when it's done: If you select this checkbox, Thingiverse will send you an email when your STL file has been created.

Create Thing: Click this button to generate the STL file.

3. The Creating your Customized STL dialog box will display a message telling you that it is generating your file. Click the link Go to my Queue to see the status of the file. [Fig. 13.2]

4. When your file appears in the queue with the status Done!, click the View Thing button. Unless you had Publish New Thing checked, the Thing page will be private.

5. In the Thing page for your new file, click the Download This Thing button.

6. In the Downloads dialog box, select the appropriate file to download

7. You can save the file to your local computer or open the file with MakerWare and print it.

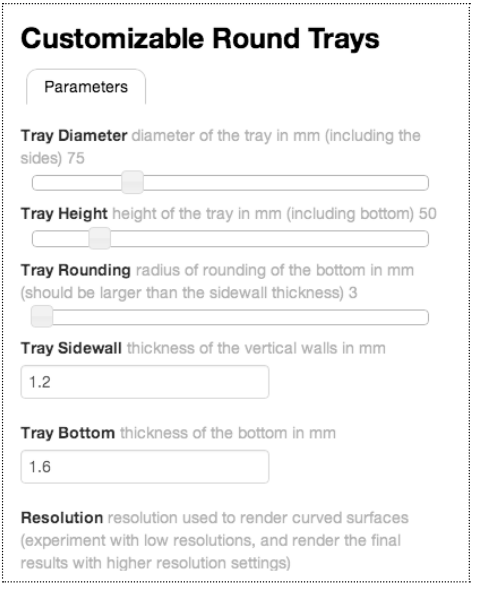

Customizable Round Trays
Parameters
Tray Diameter diameter of the tray in mm (including the sides) 75
Tray Height height of the tray in mm (including bottom) 50
Tray Rounding radius of rounding of the bottom in mm (should be larger than the sidewall thickness) 3
Tray Sidewall thickness of the vertical walls in mm
1.2
Tray Bottom thickness of the bottom in mm
1.6
Resolution resolution used to render curved surfaces (experiment with low resolutions, and render the final results with higher resolution settings)

Fig. 13. 3

EXAMPLE OF CUSTOMIZING A THING

This section will walk you through the steps to customize a thing with the Customizer application, create the STL file, and download the STL file. We will customize the thing called Customizable Round Trays. To customize this thing:

1. Go to go to http://www.thingiverse.com.

2. On the home page, use the Search field in the upper right. Search for "Round Trays".

3. In the Search Results page, find "Customizable Round Trays by walter". Click on the name of the thing.

4. In the Thing page for the thing, click the button Open in Customizer.

5. The Customizer page appears and displays the thing "Customizable Round Trays".

6. In the Parameters tab, we can edit the following parameters [Fig. 13.3]:

Tray Diameter: You can specify the diameter of the tray. In our example, set the tray diameter to 75.

Tray Height: You can specify the height of the sides of the tray. In our example, set the tray height to 50.

Tray Rounding: Specifies the curvature of the bottom of the tray. In our example, set the curvature to 3.

Tray Sidewall: Specifies the thickness of the vertical walls, in mm. In our example, set the thickness to 1.2.

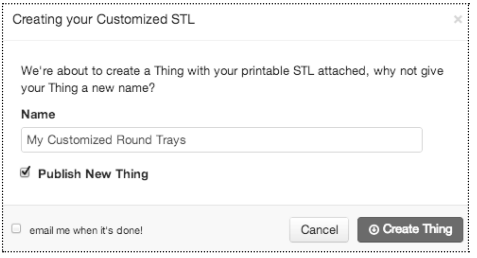

Creating your Customized STL
We're about to create a Thing with your printable STL attached, why not give your Thing a new name?
Name
My Customized Round Trays
Publish New Thing
email me when it's done!
Cancel
Create Thing

Fig. 13. 4

Tray Bottom: Specifies the thickness of the bottom of the tray, in mm.

In our example, set to 2.0.

Resolution: Specifies STL resolution. In our example, select Medium. [Fig. 13.3]

7. To save your changes and create an STL file you can download, click the Create Thing button.

8. In the Creating Your Customized STL dialog, enter the following:

Name: Name of the new STL file. In our example, enter "Customized Round Tray".

Publish New Thing: Select this checkbox to publish the STL file to Thingiverse. In our example, leave this unchecked.

Email me when it's done: Thingiverse will send you an email when your STL file has been created. In our example, leave this unchecked.

Create Thing: Click this button to begin generating the STL file. [Fig. 13.4]

9. The Creating your Customized STL dialog box will display a message telling you that it is generating your file. Click the link Go to my Queue to see the status of the new file.

10. When your file appears in the queue with the status Done!, click the View Thing button.

    Unless you had Publish New Thing checked, the Thing page will be private.

11. In the Thing page for your new file, click the Download This Thing button.

12. In the Downloads dialog box, select the appropriate file to download.

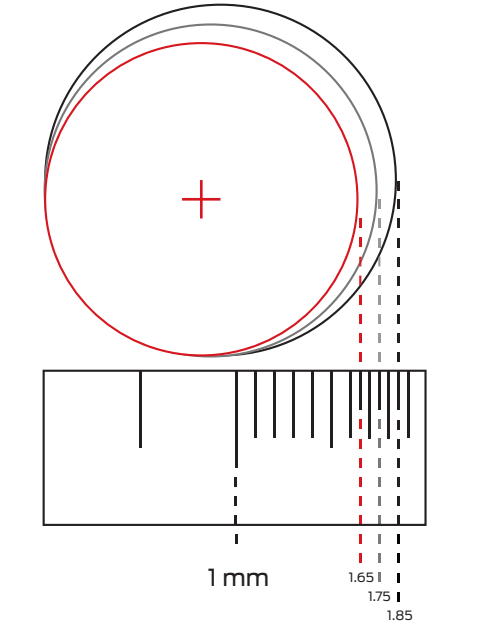
13. You can save the file to your local computer or open the file with MakerWare and print it.

14

Filament

FILAMENT BASICS

Fig. 14.1



1 milimeter = 1 inch

Fig. 14.2

Your MakerBot Replicator 2X Experimental 3D Printer uses ABS plastic filament, 1.75 mm in diameter, to print objects. [Fig 14.1] The Replicator 2X can also use 1.75 mm filament made from other plastics with similar properties. The filament used in 3D printing is also known as plastic welding rod and is used in other applications, but filament made for 3D printing needs to be more consistent in diameter.

Sometimes 1.75 mm plastic filament can vary in size between 1.65 mm and 1.85 mm. [Fig 14.2] The extruders in the MakerBot Replicator 2X can accommodate this range of sizes. The consistency of filament diameter is more important than the size of the diameter. Filament that is thicker in some places than in others is difficult for the extruder to grip. It can also result in poor print quality: a section of plastic that is too thin will result in a section of your print that does not contain enough plastic and a section of filament that is too thick will result in a section of your print that contains too much.

If you load a new roll of filament that is slightly more thick or thin than your previous roll, the extruders might feed too much or too little plastic for your print. To fix this problem, adjust the feedstock diameter in the MakerBot Slicer through the custom profiles feature in MakerWare. For more on custom profiles and the feedstock diameter setting, see the Advanced MakerWare settings page at www.makerbot.com/support/makerware/documentation/advanced.

Be careful with your filament. Keep it dry; humidity might cause it to expand. Avoid letting the filament loosen on the roll; this can result in tangles which could cause your filament to break or get stuck during a print and the print to fail.

ABS FILAMENT

ABS is short for Acrylonitrile Butadiene Styrene. It is made of a combination of those three plastics. The three plastics can be mixed in different proportions to formulate ABS intended for different uses.

ABS is tough and somewhat flexible. ABS becomes softer with increased temperatures, but at the extrusion temperatures used in a MakerBot it remains fairly viscous. That means that ABS melts quickly inside the extruder but doesn't drip during travel moves. ABS can also withstand heat well enough that we use it to make the plastic components of the Replicator 2X's extruders.

TROUBLESHOOTING

ABS has a high rate of thermal expansion, which means it expands as it is heated and shrinks as it cools. This can cause certain problems when printing.

Warping: Thermal expansion means that layers closer to the extruder are cooling and shrinking, causing strain on the layers below. The shrinking layers pull at the stable layers, warping the object.

Cracking: Cracking is a different manifestation of the same problem. When the bond between two layers is not strong, sometimes the shrinking of a section of newer layers will cause it to separate from the previous layers. This results in horizontal cracks in the side of the object.

Increasing the extrusion temperature creates a stronger bond between each pair of layers, but will also increase the temperature differential between new layers and older layers. The best way to combat both warping and cracking is to keep the whole object warm. This is why the MakerBot Replicator 2X is fully enclosed -- the heat of the extruder, instead of dissipating, stays in the build area and keeps the object at a more steady temperature.

PLA FILAMENT

PLA, or Polylactic Acid, is a biodegradable plastic with features that make it great for 3D printing -- it doesn't give off bad-smelling fumes and it has a low rate of thermal expansion, so it doesn't warp very much.

PLA is harder and slightly brittle. It is more likely to snap than bend, but that does not mean that PLA is easily breakable. PLA also stays flexible for a short while as it cools.

TROUBLESHOOTING

Extruder clogs: PLA is hard, dense, and has a low coefficient of friction, which means that it's slippery and it can be difficult for the drive gear inside your extruders to grip. If there is not enough tension on the bearing holding the filament against the drive gear, the teeth of the gear will not bite into the filament, but will scrape against it, stripping the filament. If you think you need to increase the tension on the bearing, contact MakerBot Support for advice.

PLA is also sensitive to heat. At temperatures above 55º C, objects made from PLA will start to get soft enough that they might deform if force is applied to them. At temperatures of above 150º C, objects made from PLA might start to lose their shape. PLA filament should not be heated to temperatures above 250º C because the plastic will start to break down.

If plastic stops extruding partway through your PLA prints, it is probably because the plastic is overheating. Try lowering extrusion temperature, removing the enclosure lid, and opening the door of the MakerBot Replicator 2X.

15

Updating Firmware

To ensure that your MakerBot Replicator 2X provides optimum performance, you must keep the firmware up to date.

FIRMWARE

New firmware available
Your MakerBot Replicator 2X is running firmware version 5.5. Some features of MakerWare are not compatible with your firmware, and print quality has been greatly improved with our latest firmware. We recommend that you upgrade your firmware now.
Not Now
Upgrade Firmware...

Fig. 15.1

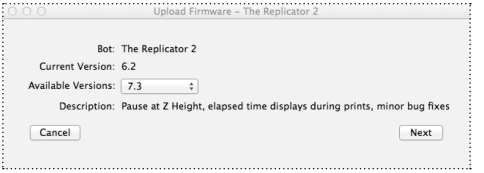

Upload Firmware – The Replicator 2
Bot: The Replicator 2
Current Version: 6.2
Available Versions: 7.3
Description: Pause at Z Height, elapsed time displays during prints, minor bug fixes
Cancel
Next

Fig. 15.2

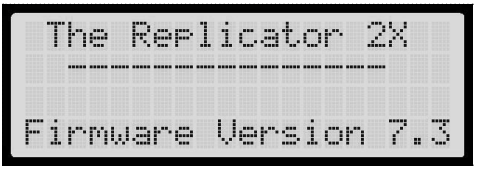


Fig. 15.3

Keeping your firmware up to date will ensure that your MakerBot Replicator 2X always operates at its best. When a new version of your bot's firmware is available, MakerWare will display a message letting you know that it's time to update. [Fig 15.1]

To update your firmware, follow these steps

1. Locate the USB-A to USB-B cable that came with your MakerBot Replicator 2X and use it to connect your Replicator 2X to your computer.

2. Choose "Upload Firmware" from the MakerBots menu. MakerWare will walk you through the rest of the steps necessary to upload new firmware. [Fig 15.2]

   When your MakerBot Replicator 2X restarts it will display the number of the new firmware version. [Fig 15.3]

16

Finishing Things

After you print an object, you can smooth it, retouch it, and paint it. This chapter will describe one method of finishing a printed object and then give a broad overview of other methods.

FINISHING THINGS

FINISHING AN OBJECT WITH PRIMER AND SANDPAPER

This method of finishing requires a matte gray spray primer, lightweight painters' spackle, and fine grit sandpaper.

1. **Prime the object.**
   For a smooth, even coat of primer, keep your hand moving as you spray the object and spray only in short bursts.

2. **Sand the object.**
   Use a fine grit sandpaper on the entire surface of the print. The primer will come off in places, revealing the layer lines. You can also use a variable speed rotary tool instead of sandpaper, but be careful to use it only at low speeds: using a rotary tool at high speeds will generate heat, which could melt the surface of your object.

3. **Apply spackle.**
   Use your finger or a paintbrush to apply spackle perpendicular to the layer lines. You can help the spackle to dry more quickly by setting it in the sun or applying hot air using a hair dryer.

4. **Repeat steps 1 – 3.**
   Continue priming, sanding, and spackling until you are satisfied with the appearance of the object. Apply only light layers of primer to avoid buildup. Apply paint to the final layer of primer.

OTHER METHODS

Retouching.

You can fix minor imperfections in an object by:

- Spraying with automotive spray filler
- Manually applying wood putty
- Manually applying modeling epoxy
- Making slurry from acetone and ABS of the same color you want to retouch. You can then paint the slurry on to the imperfection.

Smoothing.

To smooth an object, you can:

- For prints made out of ABS, rub the surface with a small amount of acetone on a cloth.
- Rub the surface with fine-grit sandpaper (dry or wet) and then wash with detergent and water.

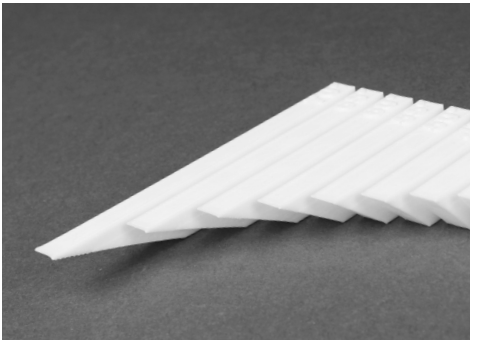
Painting.

- You can paint objects made with ABS with acrylic paints and spray paints.
- You can prep for painting with a urethane-based primer.

17

Designing for 3D Printing

3D printers can make objects that more traditional manufacturing processes, like milling and injection molding, cannot, but it also comes with its own set of strengths and weaknesses. Keep these guidelines in mind when designing models intended for 3D printing to produce successful printed objects.



File Name: Massive Overhang Test Fig. 17.1
Design by: thingster
Thingiverse: 40382

File Name: Three 1:24 Windsor Chairs Fig. 17.2
Design by: PrettySmallThings
Thingiverse: 21999

OVERHANGS [Fig. 17.1]
As your MakerBot prints your object, each layer of plastic rests on the one below. When an object has straight sides, a new layer will be fully supported by the previous layer. But when an object has parts that angle outwards (overhangs) some part of the new layer is unsupported. If it's just a thin sliver of the perimeter, the layer will still have enough support, but if more than half of that outer perimeter has nothing to rest on, you might see drooping or dropped threads of plastic. To make sure at least half of each layer's outer perimeter is supported, avoid creating overhangs that form an angle greater than 45º from the vertical.

BRIDGING [Fig. 17.2]
A thread of extruded plastic that crosses from one supported area to another supported area over an unsupported area is called a bridge. Because the thread is supported at both ends, the unsupported middle does not cause problems. But if the unsupported section is too long, you might see sagging in the middle. Your MakerBot Replicator 2X should handle bridges of 10 mm well, but you will probably see some sagging on bridges of 20 mm.

DETAIL SIZE
There is no equivalent to pixel size on a MakerBot. Layer height is used as a measure of resolution, but it only measures resolution in the Z-axis. Your MakerBot can produce its finest detail on the Z-axis. The high quality setting uses .1 mm layers, and it is possible to produce layers that are even thinner. Design with layer height in mind for even more precision: a feature .2 mm tall will be two layers tall when printed with .1 mm layers and one layer tall when printed with .2 mm layers, but will not be the correct height if printed with .15 mm or .25 mm layer heights.

There are two components to figuring out what detail size you can achieve on the X- and Y axes. First is positioning accuracy. Positioning accuracy tells us how precisely the extruder can find the spot it is looking for on a plane. X and Y positioning accuracy on your Replicator 2X is about .01 mm.

That's a number you should consider when modeling shallow surface detail, but for small stand-alone or protruding features, you will have to go larger than that. The limiting factor here is the layer width. The layer width is the same as the diameter of the extruder nozzle: .4 mm. Because a single line of extrusion is never narrower than .4 mm, no printed feature can be narrower than .4 mm.

However, most slicing engines still can't handle features that small because they can't print a line alone: each layer perimeter must be a closed loop. That means that the smallest feature you can actually print is .8 mm -- the width of two extruded lines side by side. The MakerBot Slicer's spur settings work to correct this by allowing shapes that are not closed loops, but these features are experimental.

ORIENTATION
Many of the problems you might run into while trying to print difficult models can be prevented by changing the orientation of the model on the build plate.

MINIMIZE SUPPORT MATERIAL
You can build an object of any shape using tearaway support structures, but supports can be difficult to remove and use up plastic. Make sure your object has a flat side to rest on. Orient your object to minimize overhangs and bridges. For example, printed right-side-up, these tables would have unprintable bridges and unprintable overhangs, but upside-down they print easily. [http://www.thingiverse.com/thing:18982]

MAXIMIZE OBJECT STRENGTH
Another thing to consider is the "grain" of the printed object. A thin cylinder printed upright will be composed of a series of circles placed on top of one another. If you try to break it in half, it will have as many natural breaking points as it has layers, and will snap easily. If, on the other hand, it is printed on its side, the layers will run up along the cylinder, and every layer will have to bend in order for the cylinder to break. Keep this in mind when designing objects, especially functional ones. A spool holder is a good example of an object that should be printed on its side for strength.

NOTES

18

Reference

GLOSSARY OF TERMS

ABS: Acrylonitrile butadiene styrene, a widely used thermoplastic, and the primary material used for making things on the MakerBot Replicator 2X.

BUILD PLATFORM: The support for the heated build plate. The build platform includes knobs for manual leveling.

DRIVE GEAR: The gear that pushes the MakerBot Filament into the heated part of the extruder.

DUAL EXTRUSION: A process in which two extruders loaded with two different colors or kinds of plastic work together to 3D print an object.

ENCLOSURE LID: The clear acrylic hood that helps keep warm air inside the MakerBot Replicator 2X. The enclosure lid is shipped separately.

EXTRUDER: The assembly that draws the filament from the spool, melts it and pushes it through a nozzle onto the heated build plate. Your MakerBot Replicator 2X has two extruders.

EXTRUDER FANS: The fans that keep the MakerBot Replicator 2X extruder motors cool and disperse heat from the heat sinks.

EXTRUDER LEVER ARMS: The levers on the MakerBot Replicator 2X extruders. These move the bearing inside the extruder away from the drive gear, allowing for easier loading and unloading of filament.

FAN GUARDS: The grills that protect the extruder fans and protect the user from the fans.

FILAMENT GUIDE TUBES: The plastic tubes that guide the MakerBot Filament from the filament spools to the extruders.

GANTRY: The metal rods that allow the MakerBot Replicator 2X extruders to move on the X and Y axes.

GCODE: The computer language used to describe the toolpath your MakerBot Replicator 2X will use to 3D print an object. GCode is converted to X3G before being saved to your SD card.

HEAT SINKS: The components that dissipate heat from the cartridge heaters. They look like aluminum plates with fins.

HEATED BUILD PLATE: The heated surface on which the MakerBot Replicator 2X builds an object.

INFILL: The printed internal lattice that provides structural support for your object.

KAPTON TAPE: A heat-resistant film that adheres well to ABS plastic at high temperatures. Use it to cover the heated build plate so that objects will stick to the plate during the build.

LCD CONTROL PANEL: The liquid-crystal display at the front lower right corner of the MakerBot Replicator 2X. This control panel provides status information about the MakerBot Replicator 2X and includes control menus and diagnostics.

MAKERBOT FILAMENT: 1.75mm diameter plastic welding rod. This is the feedstock for your MakerBot Replicator 2X. MakerBot Filament comes in ABS, PLA, and PVA plastics. The MakerBot Replicator 2X is optimized for ABS.

MAKERWARE: Free software created by MakerBot that allows you to load, rotate, scale, and move 3D models and create the toolpaths the MakerBot Replicator 2X uses to build objects.

MANIFOLD: A term used to describe 3D models that consist of one completely enclosed three-dimensional shape with no holes, reversed faces, or extra geometry. Non-manifold models will cause problems for 3D printing and other applications.

MOTOR ASSEMBLY: The stepper motor and the drive block that push filament into the extruder. Each extruder contains a motor assembly.

MOTOR WIRES: The bundle of electrical wires that provides power to the motors.

NOZZLES: The openings at the end of the extruders from which melted MakerBot Filament emerges to be spread onto the build plate.

PLA: Polylactic acid is a renewable bioplastic, and one of the materials from which MakerBot Filament is made.

PVA: Polyvinyl alcohol is a water-soluble plastic that is sometimes used for dissolvable support structures.

POWER SUPPLY: The A/C power supply for the MakerBot Replicator 2X. It includes a block and two plugs.

REPLICATORG: Free, open source software that allows you to manipulate and edit STL files and GCode files and save them to be printed on the MakerBot Replicator 2X.

SD CARD: Secure Digital memory card that can store digital data and be read by the MakerBot Replicator 2X. The SD card used with your Replicator 2X must be formatted FAT 16 with a maximum capacity of 2 GB.

SHELLS: Printed outlines defining the shape of each layer of an object.

SPACERS: The plastic pieces that keep the extruder fans and heat sinks secure and in place.

SPOOL HOLDERS: The plastic pieces that attach to the back of the MakerBot Replicator 2X and hold the spools of MakerBot Filament. The spool holder ensures that the MakerBot filament is fed evenly to the extruders.

STL: A widely used file format for 3D models.

.THING: A file format used by MakerWare that allows you to print multiple 3D models on the same build plate.

THINGIVERSE: A website for uploading and downloading 3D model files for use with the MakerBot Replicator 2X.

THREADED ROD: The long metal rod behind the build platform that is threaded along its entire length. This rod allows the build platform to move up and down along the Z-axis.

TOOLPATH: The set of instructions your MakerBot will use to build an object. Toolpaths for the MakerBot Replicator 2X must be saved as an X3G file.
USB CABLE: A cable that allows your computer to communicate with the MakerBot Replicator 2X in order to update firmware.

.X3G: A compact format for describing the toolpath your MakerBot Replicator 2X will use to 3D print an object.

CONTACT US

SUPPORT

makerbot.com/support

Our website has extensive documentation and troubleshooting information about your MakerBot Replicator 2X Experimental 3D Printer. It's a great resource when you want to try to solve issues quickly on your own.

support@makerbot.com

If you ever need help resolving an issue with your MakerBot Replicator 2X, send an email to the address above to open a ticket with the MakerBot Support Team. To help us understand your problem from the start, it is very helpful to include pictures or a video as attachments on your email.

SALES

sales@makerbot.com

To learn about other MakerBot products, including MakerBot Filament, please email the address above, or call our Sales Team at 1-347-334-6800.

FEEDBACK

thoughts@makerbot.com

For general questions, or to tell us what's on your mind, send an email to the address above. We love to hear from you, and using this email address helps keep our Sales and Support lines free for customers in need.

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MakerBot products do not carry a long-term warranty. Returns are possible only on unaffected items, within 14 days of receipt. After such time, all sales are considered final. "Unaffected" means a device has never been assembled, powered up, programmed, or otherwise changed. MakerBot cannot accept returns on purchased items that have had electrical power applied to them, or been otherwise programmed, changed, or affected. However, we will provide parts or service on items that prove to be defective from the time of manufacture, and we'll always work with you to get your bot running again.

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